Hayes

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POINTS OF THE HORSE

Photo by] [DIXON & SONS.

The Duke of Westminster's Ormonde.

Photo by] [CLARENCE HAILEY, NEWMARKET.

Mr. C. G. Duff's Cloister.

POINTS OF THE HORSE

A TREATISE ON THE CONFORMATION, MOVEMENTS, BREEDS AND EVOLUTION OF THE HORSE

BY

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ILLUSTRATED BY

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PREFACE.

EXACT ideas on the Conformation of the Horse are not current either in the traditions of our sporting people or in our literature. The few English authors who have written on it, have treated this important subject in a fragmentary manner, and have contented themselves for the most part with laying down rule-of-thumb maxims for the blind acceptance of their readers. The French, on the contrary, have written on *L'Extérieur du Cheval*, several elaborate books upon which they have expended an amount of scientific knowledge that does them infinite credit; but their works show that their experience has been gained more in the study and dissecting room, than in the stable and in the field, and they have made but little use of photography. As illustrations of horses drawn without the aid of photography, have a bias difficult to be repressed, they render the ideas of the artist more accurately than they portray the realities of nature.

About twenty-five years ago, while training, racing and steeple-chasing in India, I began to write a book on the Points of the Horse, which subject I resolved to treat according to the time-honoured methods of my predecessors. Subsequently, I worked at it while studying to become a veterinary surgeon, and while living at Newmarket, where I went to increase my knowledge of English thorough-breds, for which object I obtained every facility from many kind friends, who were either owners or trainers, and who were always glad to show me their horses, and discuss their various points. When the book was completed in 1884, I despatched the manuscript to my publishers by the hand of a friend, who, by an extraordinary piece of good luck, lost it so effectually that I have not seen it since. While suffering from the shock caused by the loss of five years' toil, I happened to read Professor Marey's *Machine Animale*, and before I had got half through it, I grasped the fact that I had been working in an entirely wrong groove, and that my careless friend had, most fortunately, saved me from publishing a comparatively worthless book. In 1885, I went abroad on a horse-breaking tour with the growing embryo of a new book in my brain, and finished this literary task after eight years of hard practical work (breaking, training for racing and chasing, and horse dealing) among horses in India, Burma, Ceylon, China, Japan, Egypt, South Africa, England, and elsewhere. The facilities afforded me by such a life and by the kindness of horse-loving friends, enabled me to obtain photographic illustrations and information which could not have been procured under less favourable circumstances.

On returning to England, I brought out the first edition of this book, which was so kindly received by the public that it was sold out in six months. Having by that time settled down in Melton Mowbray, I became aware that the illustrations in the book were far from being complete, and that, to do justice to the subject, it was necessary for me to renew my acquaintance with certain classes of English horses, and especially with hunters. Hence, instead of meeting the demands of the literary market by an immediate reprint, I continued my studies among horses for two years in Leicestershire and one year in Cheshire; hunting, breaking, training, and practising as a veterinary surgeon. I received such great kindness from horse owners and photographers, that I was able to add 142 reproductions of photographs to the second edition, which was published in the beginning of 1897.

After the second edition came out, I went to Russia three times with horses for sale, was officially engaged for six months at the Russian remount depots, had a season's hunting in the Midlands, and went twice to South Africa during the late war, in veterinary charge of remounts. The varied experience thus gained, impressed on me more strongly than ever the necessity of taking a still broader view of horses, by describing and illustrating by photographs the breeds of many countries, and also wild asses, zebras and equine hybrids. I could not have done this work without the generous and valuable assistance of the Duchess of Bedford; Lord Arthur Cecil; Professor Cossar Ewart, F.R.S.; Mr. Foster, of Boston; Mr. Reynolds, M.R.C.V.S., of Bohemia; Mr. Della Gana, F.R.C.V.S., of Teheran; Dr. Rutherford, of Canada; Sir Walter Gilbey; Major Schoenbeck, of Berlin; Mr. Grimani-Smith, of Queensland; Professor Warington, F.R.S., Mr. J. W. Harding, of New Zealand; Mr. Hunter, F.I.C.; Mr. McConnell, B.Sc.; Dr. Salmon, of Washington; Mr. H. T. Barclay; Dr. McClean, of Constantinople; Professor Boyd Dawkins, F.R.S.; Mr. Delton, of Paris; Mr. Forbes, M.R.C.V.S., of Montana; Mr. Fitzwilliams, of Sumatra; Mr. Maschmayer, of Sumatra; Mr. Cecil Gosling, of Paraguay; Mr. George Ketcham, of Ohio; Mr. G. A. Ewart; Mr. Eric Maxwell, of Perak; Mr. Clarence Hailey, of Newmarket; Mr. Carl Hagenbeck, of Hamburg; Mr. Josiah Newman; Mr. Bell, of Newmarket; Professor Dunstan; Mr. Wharam, M.R.C.V.S.; Mr. Burkill, of Shanghai, and many other kind helpers. I am particularly indebted to Professor Cossar Ewart for the valuable scientific information he gave me on subjects discussed in the following pages, and for correcting the proofs of this edition, which is nearly twice as large as the previous one, and contains 279 new photographic illustrations.

1st December, 1903.
Authors' Club,
3 *Whitehall Court*, *S.W.*

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CHAPTER I.

FIRST PRINCIPLES OF CONFORMATION.

Varieties of Conformation—Animals of Speed and Animals of Strength—Endurance—Soundness.

Varieties of Conformation.—The chief varieties of conformation, from a useful point of view, are those of speed, strength, endurance, and soundness.

Animals of Speed and Animals of Strength.—When we speak of the conformation of a horse, we refer to the adaptability of his body for general or special work. We all know, without the aid of science to tell us, that a light-boned thorough-bred would be as unsuitable to carry a fifteen-stone man, as a thick-set cob would be to win a five-furlong race. The "weed" would not fail, necessarily, from deficiency in weight of bone and muscle; for there are many ponies of thirteen hands or under, which would not weigh more than a slender five-furlong performer, and yet could bear a welter burden through a long day's journey, with ease to themselves and comfort to their rider. The failure to carry weight in the one case, and the inability to display a high degree of speed in the other, would obviously be due (in the absence of any particular defect) to the fact of the conformation of the animal

Photo by] [Dixon & Sons.

Fig. 1.—Indian Black Buck.

Photo by] [M. H. H.

Fig. 2.—Indian Buffalo.

Photo by] [M. H. H.

Fig. 3.—Cheetah.

Photo by] [M. H. H.

Fig. 4.—Lynx.

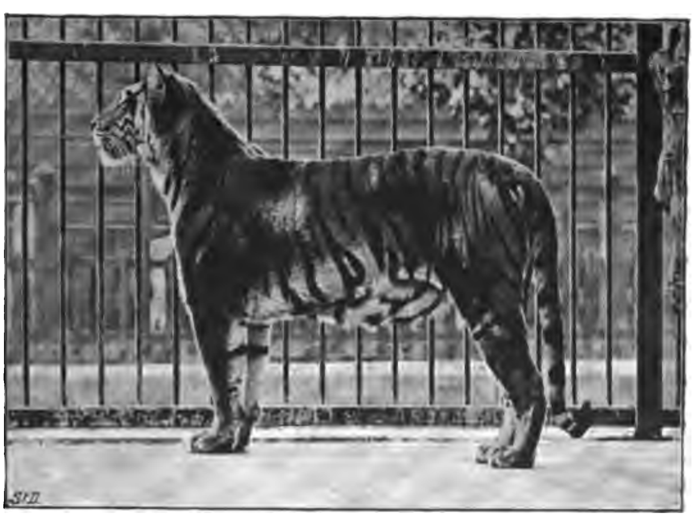


Photo by] [DIXON & SONS.

Fig. 5.—Tiger.

not being suitable to the kind of work to which he was put. In our study of the "make and shape" of horses, we may profitably begin by taking a comparative view of animals of great speed and those of immense strength, so as to arrive at a knowledge of the principles by which their special characteristics are developed to a high degree of excellence. As the conformation best adapted for the one is different from that for the other, we cannot find both united in the same animal. It is evident that the suitability of horses to the kind of work they are required to perform, depends upon the manner in which their respective proportions of speed and strength are varied. Thus, a dray-horse which can trot a mile in eight minutes with 3,000 lbs. behind him, may be quite as useful, in his own way, as a match-trotter which, with a sulky and driver weighing together 150 lbs., can do a mile in two minutes twenty seconds.

On examining the subject of comparative conformation, we find that mammals (animals which suckle their young) of speed and mammals of strength differ essentially in shape from each other, and that individuals of each respective class have a similar kind of conformation. As an example of the gallopers, let us take the Indian black buck (Fig. 1), which, for half a mile, could give five hands and a beating to the fastest horse that ever looked through a bridle. Then there is the cheetah (Fig. 3), which can give the antelope 100 yards start and catch him in a furlong. It is true that the spotted cat effects his purpose a good deal by surprise; but it is equally certain that for a couple of hundred yards he can travel with the velocity of an express train. Also, there is the greyhound (Fig. 8), with whose speed we are all familiar. In comparison with these fleet-footed animals, let us note the "make and shape" of the buffalo (Fig. 2), which is endowed with vast muscular power; and, as the opposite of the "long-tailed dog,"

Photo by] [M. H. H.

Fig. 6.—Indian Trotting Bullock.

Photo by] [M. H. H.

Fig. 7.—Indian Heavy Draught Bullock.

let us take the bulldog (Fig. 10). On examining these animals, we shall find that the limbs (especially the hind ones, from which is derived the greater part of the forward propulsion) of the gallopers are much longer in proportion to the animal's height, than those of the representatives of strength. We see this fact best illustrated when we compare individuals of the same species or family, like the greyhound (Fig. 8) and bulldog (Fig. 10), or the cheetah (Fig. 3) and tiger (Fig. 5), which is the strongest member of the cat tribe. A greyhound (Fig. 8) and a race-horse (Fig. 9) possess many points in common, and the same may be said about a bulldog (Fig. 10) and a heavy-draught horse (Fig. 11). We also obtain good examples among horned cattle, in the Indian trotting bullock (Fig. 6), and the Indian heavy draught bull (Fig. 7), whose sex is indicated by the large size of his hump. Special length of hind limb is well shown in the hare and in the lynx (Fig. 4), both of which are animals of great speed. As it is not the custom to breed men with reference to their physical development, we do not find the difference in question so well marked in them as in the lower animals; yet we can note among "sprinters" and wrestlers the working of this principle. We should bear in mind that the muscles of the limbs of the horse, ox, buffalo and antelope, unlike those of the dog and cat tribe, are, practically speaking, continued only in the form of tendons, below the knees and hocks.

From the examples cited of animals of great strength and those of high speed, we may conclude that the former are distinguished by a long body and short legs; and the latter, by a short trunk and long extremities. I am here assuming that the length of the body is taken comparatively with that of the legs, and without reference to the proportions of the body itself.

We can also observe from the photographs before us, that the limbs of speedy quadrupeds are proportion-

Photo by] [BARRAUDS, LIVERPOOL.
Fig. 8.—Mr. G. F. Fawcett's Fabulous Fortune (winner of the Waterloo Cup, 1896) and his trainer, T. Wright.

Photo by] [W. A. BOUCH, 161, STRAND, W.C.
Fig 9 —Mr. Sievier's Sceptre.

ately as slender as they are long, and that those exhibiting great strength are relatively thick and short.

Muscles are the active and essential part of the machinery used by animals in locomotion, bones being merely passive agents. In fact, there are myriads of the lower animals which move about with considerable speed by means of their muscles, but which have no bones of any kind.

Professor Marey points out in his book, *La Machine Animale*, that the thickness of a muscle is proportionate, as a rule, to its power, and that its length is proportionate to the extent of movement which it is able to produce. He gives, as instances, the long and narrow breast-bones of birds—such as the pheasant (Fig. 12)—which can move their wings through very large angles; and the short and broad ones of birds—such as the albatross (Fig. 13)—which can move them only through relatively small angles. The former are therefore able to work their wings with great rapidity; and the latter can overcome the immense resistance of the air upon which the large area of their pinions presses, only with slow, but very powerful strokes. The expanse of the outspread wings of birds of quick-stroke is of far less comparative size than is that of those large-winged birds. The relative speed with which birds can cleave the air does not, of course, affect the question of the form and action of their muscles.

Endurance.—From a general point of view, endurance ("staying power"), whether in the exhibition of speed or strength, depends on the amount of force (energy) which the system can supply.

In a steam locomotive, movement is obtained by a series of changes in the force which is contained in the fuel, and which is the chemical affinity (chemical attraction) that the elements of the fuel have for the oxygen of the air. The first change in this series is the conversion of the chemical affinity into heat. For instance,

Photo by] [T. FALL, 9, BAKER STREET, W.
Fig. 10.—Bulldogs.

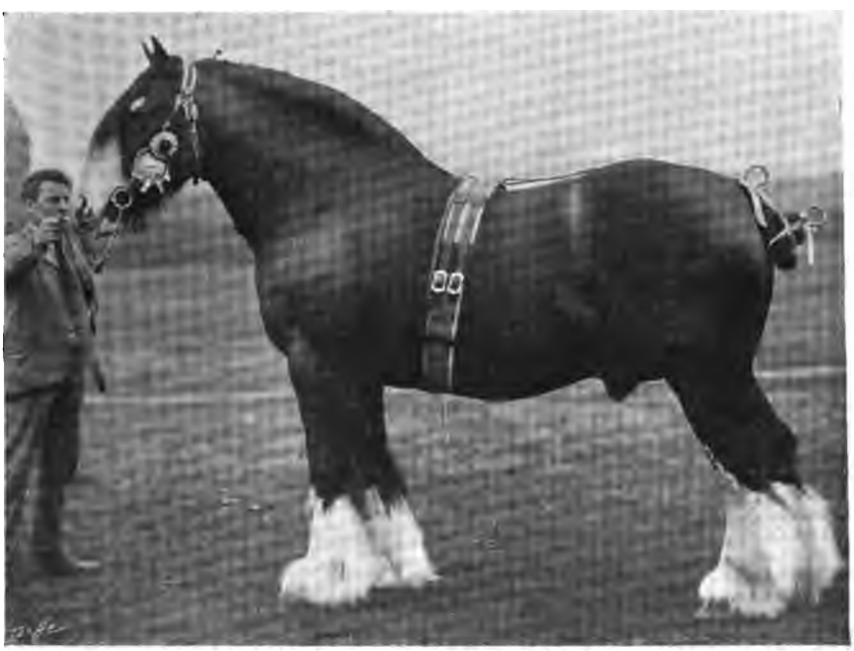


Photo by] [F. BABBAGE, 46, ALBERT STREET, N.W.
Fig. 11.—Messrs. Forshaw and Sons' Shire Stallion Stroxton Tom. Champion at the London Shire Horse Shows, 1902 and 1903.

heptane, which is the chief constituent of paraffin oil, is a combination of 7 atoms of carbon (C) and 16 atoms of hydrogen (H), both of which elements have a strong affinity for oxygen. When the oil is ignited, its carbon and hydrogen unite with the oxygen of the air, as we may see by the following equation:—

$$\underset{\text{(Heptane)}}{C_7 H_{16}} + \underset{\text{(Oxygen)}}{11\, O_2} = \underset{\text{(Carbonic acid gas)}}{7\, CO_2} + \underset{\text{(Water)}}{8\, H_2 O.}$$

This conversion of chemical affinity into heat is somewhat similar to that which we see when a heavy stone falls on hard ground from a high cliff, in which case, gravitation (the attraction which all bodies in the universe have for each other) is converted into movement; and movement into heat, as we can feel by placing our hand on the spot that has been struck. Unlike gravitation, chemical attraction can act only when bodies (molecules or atoms) which have this affinity for each other, are very close together.

After the latent energy in the fuel of a steam engine has been changed into heat, the heat that has been transmitted into the boiler becomes converted into another form of force (repulsion), which causes the particles of the confined steam to recede from each other, and consequently to exert pressure on the piston; and finally this pressure becomes changed into movement. As some of the constituents of coal are already oxidised, and as it contains a certain proportion of mineral matter, it is not such a potent force-producer as paraffin oil.

In horses, as in men, the fuel for the maintenance of heat and movement is obtained from that portion of the food which has been assimilated (taken up by the system), and is distributed in varying proportions throughout the body. There are many kinds of this animal fuel, all of which, in order to be effective, must contain elements that have an affinity for oxygen and that have not yet been oxidised. For instance, glycogen ($C_6 H_{10} O_5$), which is undoubtedly a valuable form of fuel in the animal economy, and which is formed in the liver, contains five parts of water and six parts of carbon. The fuel is conveyed in a dissolved state to the various tissues by the arterial blood, which is pumped to its many destinations by the heart. The lungs obtain oxygen from the breathed-in air and supply it to the blood, which carries it to the tissues along with the fuel. The waste products (carbonic acid, urea, surplus water, etc.) are removed from the system, chiefly by means of the lungs, skin, heart, kidneys, and intestinal organs.

From the foregoing considerations, we can see that the conformation of a stayer must be such as will afford by acids the earthy part is dissolved out, or on the other hand when the animal part is burnt out, the shape of the bone is alike preserved" (*Kirkes*). The function of the mineral matter is to give rigidity and hardness to the bone; and that of the animal tissue, to bind the earthy particles together, so that the bone may be able to resist a considerable amount of strain and concussion. This action on the part of the animal tissue of bone is well shown by the fact that when a bone has been deprived of its animal matter by intense heat, it becomes extremely brittle. Also, certain constitutional changes which injuriously affect the muscular and fibrous structures of the body, render the bones more or less brittle, which is the case with advancing age, and when an animal has been deprived of exercise for a comparatively long time. Many persons think that as mankind and animals grow older, the proportion of earthy matter in their bones becomes greater; but Fremy has shown by analysis that age has very little influence in this case. Rutherford explains that the probable cause of bone becoming brittle with age, is a molecular change in its fibrous tissue. The foregoing observations show that the good quality of the bones of an animal is more or less similar to that of the other tissues of the body, and especially to the muscles which move the bones and to which the bones are attached.

Whether a horse be intended to carry heavy burdens, or to gallop over hard ground, it is always a matter of the greatest importance that his bones, especially those below his knees and hocks, should be strong. It has been customary to state, in a vague way, that the bones of Arab horses and English thorough-breds are denser than those of other breeds. It would, however, be more exact to say that the drier the soil on which a horse has been bred and brought up, and the "harder" the food upon which he has been fed, the better will be the quality of his bone; for we find that in dry, hot climates in the East, native ponies which have little or no admixture of Arab blood, have legs as clean and hard as any that are to be met with in the Desert. The nature of a horse's hoofs, which can always be determined by inspection, or by using the "drawing knife," will generally afford us a safe guide by which to judge of the quality of his bone. Thus we find that animals which have been reared amid damp surroundings and on succulent food, will, as a rule, be prone to bony enlargements, and will have flat feet of soft horn. We cannot fail to notice this, if we compare the horses of the English fen counties with those bred on high, dry land; or animals raised in the arid plains of the Punjab and Deccan, with those of swampy Lower Bengal. Hence, if, when judging an animal about the history of which we know nothing, and which does not appear to have undergone enough work to test the soundness of his legs, we find that he has weak, flat hoofs, we shall not err, in the large majority of cases, by concluding that his bone is of inferior quality. Although dryness of climate is always a favourable condition for horses, excessive heat diminishes the size of the bone of the indigenous animals: a circumstance which may, to a great extent, account for the fact that horses bred in tropical climates, however hardy and wiry they may be, are very rarely of a weight-carrying type.

The popular term "bone" refers to the circumference of the legs below the knees and hocks, as compared to the weight they have to carry. As the limbs of the domestic horse, especially when used at fast paces and when jumping, have far more strain put upon them, than if the animal were in a wild state, the judicious breeder will try to obtain as much "bone" as possible, by taking advantage of the all-important principles of variation and heredity. This necessity is inculcated by the proverbial saying that "a horse is as old as his legs." The bones of the limbs, like tendons and ligaments, may be looked upon as adjuncts to, or component parts of, their muscles, which are the active organs of movement. All these structures are dependent for their development on the blood supply, which is increased by exercise. Thus, continued idleness causes the bones, tendons and ligaments of the legs to become abnormally liable to injury. Also, in cases of paralysis of a limb, the bones, as well as the muscles, waste. Hence, when judging of a horse's capacity for standing work, we must not confine our attention to his "bone," without also considering the condition of his muscles, tendons and ligaments. In making practical observations on horses, we may often be greatly assisted in our investigations by judging of the muscles by the bones; and *vice versâ*. Thus, if we see an animal in poor condition which has been brought on by hardship or want of food, we may, by the appearance of his "bone," form a good idea of what his muscles will be when he "fills out." Even when a horse is "fit and well," a display of large, well-shaped bone (of the body as well as of the limbs) should prompt us to consider that his muscles are more powerful than they appear at first glance. I was much struck by this fact when I had the pleasure of closely inspecting the celebrated St. Gatien, whom Mr. John Hammond very kindly showed me in his box, some time before he ran his dead-heat with Harvester for the Derby of 1884; for I was greatly "taken" with the sight of the large, symmetrically formed bones of his legs, his long back ribs, and his well-developed pelvis, the inner angle of which was so prominent as to make a distinct "rise" in the outline of his croup; not to mention his long, sloping shoulders and immense gaskins. St. Gatien would probably have been the greatest race-horse of all time, had he not suffered from a severe attack of influenza after he won the Cesarewitch as a three-year-old, with 8 st. 10 lbs up. On the other hand, if we observe that an animal which is in "dealers' condition" is light of bone, we may, as a rule, conclude that there is not much muscle in the load of meat which he carries. Among sound, good horses, "Mr. Morton's" Dalmeny was one of the lightest below the knee I have ever seen; but no exception could have been taken to him on that account, for his legs had no superfluous weight to carry, and his muscles were of the long, slender type, which is generally characteristic of the possession of speed. The bones and muscles of the limbs are not always in keeping with those of the body; for we daily see instances of animals that are too heavily "topped" for their legs.

Men of experience know that a horse should have plenty of "bone" in order to be able to carry weight with ease to himself for long distances and at comparatively fast paces—as, for example, when hunting. If we take two horses that can perform about equally well in a long run with a similar welter weight up, one having the "pull" in speed, the other in bone and muscle, we shall usually find that the latter will not feel the effects of the work so much as the former. This fact can be explained by the reasonable supposition that the weight-bearing muscles of the lighter-built horse, not being so strong as those of the "heavier" animal, will naturally become more fatigued. The objection sometimes advanced against thorough-breds for hunting, that they cannot "come out again" as quickly as half-bred animals, is valid, especially when the former are lighter built than the latter. Also, blood horses, as a rule, are bred for speed and not for endurance (pp. 426 to 434).

Large muscles, as we have seen, require large bones. It is also evident that bones which are exposed to the effects of concussion, should be dense and strong. Consequently, we may conclude that the lighter an animal's body is, in comparison to the strength of its component parts and the amount of its muscular force, the greater will be its powers of rapid progression. Hence we find that the race-horse, like all quadrupeds of which speed is the chief characteristic, has comparatively slender bones of extremely dense texture, and that his muscles are particularly strong for their thickness. Owing to the law of compensation, which governs the conditions of animal life, it is almost impossible to obtain bone of great volume, and, at the same time, of the finest quality. On this account, as weight is indispensable in the cart-horse, we endeavour, with him, to obtain large bone of sufficient strength to meet his requirements. In the intermediate classes of horses, the relations between volume and quality should be judged according to the nature of the work in view.

Arrangement of bones.—The relative position which bones occupy with respect to each other, affect their leverage, weight-carrying, and concussion-resisting powers —conditions which will be treated in detail when the various points which they affect are considered.

Cartilage.—Cartilage or gristle is a strong, flexible, bluish-white substance which is found in connection with bone, and of which there are various kinds. *Articular cartilage* covers the ends of bones that form movable joints. *Temporary cartilage* is bone in a transition form. The ribs are connected to the breast-bone by cartilages which form elastic prolongations. Cartilages also are interposed between the bones of various joints in order to connect or protect them. The *cartilage of prolongation* forms an elastic continuation of the top of the shoulder-blade.

Muscles and Tendons.—The animal's moving power is derived from *muscles*, which form the lean of meat, and which, as a rule, are attached to bones. Muscles act by virtue of the property they possess of being able to shorten themselves on being stimulated by the nervous system. Thus, if we wish to raise, say, our right hand to the shoulder, our brain telegraphs, so to speak, the order, by means of the nerves, to the *biceps* muscle, which is attached at one end to the shoulder-blade, close to the shoulder-joint, and, at the other, to the bones of the fore-arm, a little below the elbow. Hence this muscle, on contracting, draws the hand up in the required direction.

As muscles are built up of contractile fibres, their strength, other conditions being equal, is proportionate to their thickness.

In order to economise space, muscles are generally attached to bones by means of *tendons* (sinews), which are hard, fibrous cords of great toughness. In these cases, the tendon at one extremity is united to the end of the muscle; and, at the other, to the bone. Tendon is a changed form of muscle. "It is very difficult to determine how the muscle and tendon are joined, or by what means the union is brought about, for the parts become insensibly blended" (*Bland-Sutton*).

We find from experiment that a muscle can contract to about two-thirds of its ordinary length, which is, therefore, proportionate to the extent of movement it is capable of producing. If the muscles which move the limbs be comparatively short, the stride will also be short and the horse will be slower than he would otherwise be, no matter how thick and powerful are his muscles. We may, therefore, conclude that speed is associated with length of muscle, as has been stated in Chapter I.

As length of muscle is necessarily accompanied by length of bone, we may judge of the former by the latter, which can usually be readily estimated.

The "give and take" principle, which applies more or less to all created things, holds good with muscles. Hence, in the race-horse, for which the possession of speed is the chief essential of success, we should seek the greatest possible length of muscle, with just sufficient strength to meet his requirements for carrying weight and for sustaining the exertion he may be called upon to undergo. In the cart-horse, on the contrary, thickness of muscle is the greatest desideratum, always supposing that he has sufficient activity to walk well, and occasionally to trot at a moderately brisk rate. As a thin muscle will contract at least as quickly as a thick one of the same length, it follows that an increase in the thickness of muscles is useful only in making the work more easy, and that it does not otherwise add to the speed. Massive muscles, compared to slight ones, have two disadvantages, namely—they increase the weight which is carried, both in muscle and bone; and they necessitate the possession of large joints, which, from increased friction, are not so easily bent and extended as smaller ones; besides, it has been proved that they do not respond as quickly to nervous stimulus. Although it is impossible to lay down any exact rules on this subject, we may say, speaking generally, that the thickness of muscle which would be commendable in a weight-carrying hunter, would be quite out of place in a race-horse, as we may see by comparing Fig. 385 with Fig. 384. We may often observe that race-horses which were very smart as two-year-olds, lose their "form" after that age without any assignable reason, except that as they "thickened," they got slow. It is instructive to note that those speedy animals, the cheetah, greyhound, and antelope, like the race-horse, are comparatively narrow behind, and that the hind-quarters of the cart-horse are wide (Fig. 335). The muscular development to be sought for in the race-horse, in order to enable him to carry weight (within racing limits) and to stay, should be obtained with a minimum increase to the burden the animal has got to move; and is to be looked for chiefly in the loins, gaskins, and fore-arms, with great rotundity and comparative length of the back ribs, and comparative thickness of bone just below the hocks. In this respect, Ormonde (Frontispiece), St. Gatien, Bendigo (Fig. 50), Isonomy, Barcaldine, and

Carbine (the New Zealand son of Musket), for example, were all muscular horses. St. Simon (Figs. 16 and 17) was a notable example of a horse of the highest class being of remarkably light build. He had, however, marvellously good shoulders and loins.

We know from experiment that muscles of the same thickness are stronger in animals of one species than they are in those of another kind; and we may reasonably infer that even among individual horses the same rule holds good. In fact, we may take for granted that the "quality" of muscle, tendon and ligament, as well as of bone, is better in some horses than in others; the great factors in producing strong tissue appearing to be: heredity; residence in a dry, temperate climate; food obtained from a limestone soil (p. 404 *et seq.*); and exercise.

Ligaments.—The ends of the bones that form joints are held together by *white ligaments*, which are similar in structure to tendons; but, unlike them, they serve to connect bones with bones, and, in a few cases, bones with tendons. They have no direct connection with muscles. There are, also, *yellow ligaments*, which are elastic. Several of the ligaments aid in supporting bodily weight without fatigue to the animal.

Dr. Bland-Sutton (*Ligaments, Their Nature and Morphology*) points out, that ligaments, like tendons, may arise from a degenerative change in muscles, and, also, from degeneration of bone and cartilage.

Connective Tissue.—The skin, which covers and protects the body, is largely composed of a strong, fibrous structure called *connective tissue*, which, proceeding inwards from the skin in the form of, more or less, thick layers and bands, furnishes a supporting network for the component parts of the other tissues. Thus, if we compare a slice from the under-cut of a sirloin of beef with one from a round of beef, we shall see that the relative coarse-

Fig. 16.—The Duke of Portland's St. Simon, as a three-year old.

Fig. 17.—The Duke of Portland's St. Simon, as a three-year old.

ness of grain of the latter is due to the thickness of the layers of connective tissue which run through it. As connective tissue has only the passive action of support, it is evident that the coarser in grain a muscle is, the less powerful will it be; although it will be better able to resist the effects of external violence than one of finer grain. The protective duty of connective tissue, as regards muscles, may be readily inferred from the fact that the less exposed muscles are to injury from without, by reason of their position, the less connective tissue do they contain. This tissue, also, forms ligaments and tendons, and ensheathes bones, cartilages, nerves, etc. There is always a large amount of it immediately underneath the skin, in the form of loose fibrous sheets, as we may see in the dead animal. The presence of a great quantity of it in this position naturally causes the underlying parts to be ill-defined, a fact which is especially noticeable about the tendons and ligaments below the knees and hocks, owing to the absence of muscle about these parts. We may, therefore, draw the following deductions: (1) That, as the thickness of the skin is a measure of the amount of connective tissue it contains, the thicker the hide, other things being equal, the more connective tissue will there be in and about the muscles. (2) That, as its action is only passive, the more of it a muscle contains, the slower will be the movements of the muscle. Hence, we may reasonably conclude that the fact of a horse having a thick skin, and, for instance, ill-defined suspensory ligaments, owing to natural "fleshiness," would warrant us in supposing that he was deficient in speed. With age, the amount of connective tissue in the body greatly increases. As Guérin states: "In the old man, the tendon seems to invade the muscle, so that the portion of the calf of the leg which remains is placed very high, and is much reduced in length. The muscles of the loins and back present the same character. In old age they are poorer in red fibre, but richer in tendon."

The component parts of the body which, respectively, have the same structure, are called *tissues*. Thus we have bony tissue, consisting of bone; muscular tissue, of muscle; nervous tissue, of nerve substance; connective tissue, of white fibrous material; and so on.

The Nervous System.—While considering the form of the horse from a mechanical point of view, we must not lose sight of the marked. differences which exist in the nervous system of various animals, and which greatly heighten, or may altogether nullify, advantages obtained from good conformation. We are aware, speaking within reasonable limits, that the amount of contraction—*i.e.*, force—exhibited by a muscle is proportionate to the degree of stimulation given by its nerves. As the nervous system of some animals acts far more energetically than that of others, it follows that the former, other things being equal, will be stronger than the latter; although no difference in conformation, or in development of muscle, may be perceptible. Not only does the amount of nervous force differ much among animals of the same kind; but some individuals of the same species can stimulate their muscles by means of their nerves quicker than their fellows. We see this well exemplified in adepts at fencing, cricket, boxing, and other kindred sports; at which, so-called quickness of eye is all essential. The brilliant batsman or accomplished *maître d'armes*, apart from the possession of the necessary amount of knowledge, judgment, and physique, excels because he has the gift of moving his muscles, in response to the stimulus received by the nerves of his eyes, quicker, as well as in more accurately regulated style, than ordinary men. This assertion is in no way based on mere theory; for we find that among men whose duty it is to record (as in observatories) the exact moment at which they see certain phenomena occur, it is necessary, in order to avoid error, to allow for the difference in time these men, respectively, take; although it may be only a fraction of a second. To do this, it is requisite to obtain, for each man, his "personal equation." We can, therefore, conclude that speed and strength are as dependent on the nature and quality of the nervous system as they are on conformation and muscular development. We all know that a horse may possess every physical excellence, and yet be worthless on account of having a "soft heart," or bad temper.

Special nervous co-ordination is an important factor in movement. Thus we find that some horses and men who are extremely fast walkers, are poor "sprinters." Also, the trotting ability of American "standard-bred" champions, like Lou Dillon and Cresceus, is evidently much more dependent on nervous peculiarity, than on conformation. The strong influence of heredity in this case, justifies the American idea that the "trotting faculty" is a "gift." At the same time, we must bear in mind that the speed in question could not be obtained by any special nervous adaptation, unless the conformation was suitable to its application. I am strongly of opinion that "cleverness" in jumping greatly depends on special nervous co-ordination.

CHAPTER IV.

SKETCH OF THE ANATOMY OF THE HORSE.

Definitions—Bones—Joints and Ligaments—Muscles—Heart and Lungs—Nervous System—Teeth.

Definitions.—When one bone unites with another bone, or with a piece of cartilage, to form a joint, it is said to *articulate* with it. The term *articulation* is used as a synonym for *joint*.

A *ball and socket joint* is formed by the head of one bone resting in a cavity of another bone. The more shallow the cavity, the more extensive will be the power of movement. The horse's shoulder joint and hip joint are good examples of this kind of articulation. A *hinge joint* is one which works only by extension and flexion, like the horse's knee.

"A limb," as Professor Huxley states, "is *flexed* when it is bent; *extended*, when it is straightened out." We may adopt this definition, with the exception that the fetlock joint becomes bent when it is extended, and straightened out when it is partly flexed.

If a muscle is attached, by one end, to a bone which it can move, and, by the other end, to one which is fixed, the former is called the *insertion* of the muscle; the latter, the *origin*. Thus, the origin of the biceps in man (p. 28) is near the shoulder joint; and its insertion is on the bone of the fore-arm. When a muscle, on contracting, can move the bones at both its ends, the points of connection are called *attachments;* an expression which is also applied collectively to the origin and insertion. Muscles are not invariably attached to bones, but may, on the contrary, be connected to cartilages, ligaments, fibrous covering of muscles, or even to the skin.

Bones.—The skeleton is composed of the limbs, head, spinal column, and its accessory bones (Fig. 18). A *vertebra* is one of the short bones which form the spinal column that extends from the head to the end of the tail. There are, as a rule, seven vertebræ of the neck, eighteen of the back, six of the loins, five of the croup (*sacrum*), and from thirteen to twenty of the tail. All the vertebræ, except those behind the fourth or fifth vertebra of the tail, have a canal in which the spinal cord lies. Their joints have more or less power of movement, except those of the croup, which, in the grown-up horse, form a solid bony mass.

The *withers* are the long spines of the seven or eight dorsal vertebræ which come after the first. The spine of the fifth dorsal vertebra forms the summit of the withers.

On each side there are eighteen *ribs* (eight true and ten false) attached to the dorsal vertebræ. Both kinds have pieces of cartilage attached to their lower ends. The true ribs are connected by their respective cartilages with the breast-bone; but the false ones are only indirectly connected to it, the cartilage of the first false rib resting on that of the last true one; that of the second false rib, on the first false one; and so on.

The *fore limb*, according to Chauveau and other veterinary anatomists, consists of the shoulder-blade, humerus, bones of the fore-arm, knee, cannon-bone, splint bones, long pastern bone, short pastern bone, pedal (coffin) bone, two small bones at the back of the fetlock (sesamoid bones), and the navicular bone, which lies at the back of the joint formed by the short pastern bone and pedal bone. English comparative anatomists consider that it is incorrect to include the shoulder-blade among the bones of the fore-leg; but, in discussing conformation, it is well to do so, on account of the very important part which it plays in the movements of that limb.

The *shoulder-blade* (*scapula*) is a broad, thin bone, which is flat on its inside surface and has a narrow ridge of bone (the spine of the scapula) on its outer surface. This spine serves as a partition to divide the muscles which extend the shoulder joint from those that flex it. The *humerus* is the bone which lies between the shoulder joint and the elbow joint.

There are two bones of the fore-arm, namely, the *radius*, which makes a joint with the humerus and with the bones of the knee; and the *ulna*, which is united to the back and upper part of the radius, above which it projects. The upper part of the ulna is called the *olecranon*, the top of which is termed the *point of the elbow*.

There are two rows of bones of the *knee*, at the back of which a bone (the *pisiform*) is placed. It is curved inwards so as to form a groove for the passage of the back-tendons of the fore-leg.

The two *splint bones* are placed at the back of the *cannon-bone*, one on the outside, the other on the inside. They form a groove in which lies the upper portion of the *suspensory ligament*.

There is a joint between the cannon-bone and the *long pastern bone*, between the two pastern bones, and between the *short pastern bone* and the *pedal* (*coffin*) *bone*. The *navicular bone* articulates with both the short pastern bone and the pedal bone. It and the two bones behind the fetlock (the *sesamoid bones*) serve as pulleys for one of the back tendons.

The *pelvis*, which rests on, and is firmly attached to, the sacrum, appears as a single bone in the adult animal, although it really consists of two halves, each of which is composed of three bones (*ilium*, *pubis*, and *ischium*). The ilium is the analogue of the scapula in the fore-hand. Each half furnishes a socket for the head of its respective thigh bone. The *point of the hip*, on either side, is the front and outer corner of the pelvis. The two inner corners of the pelvis

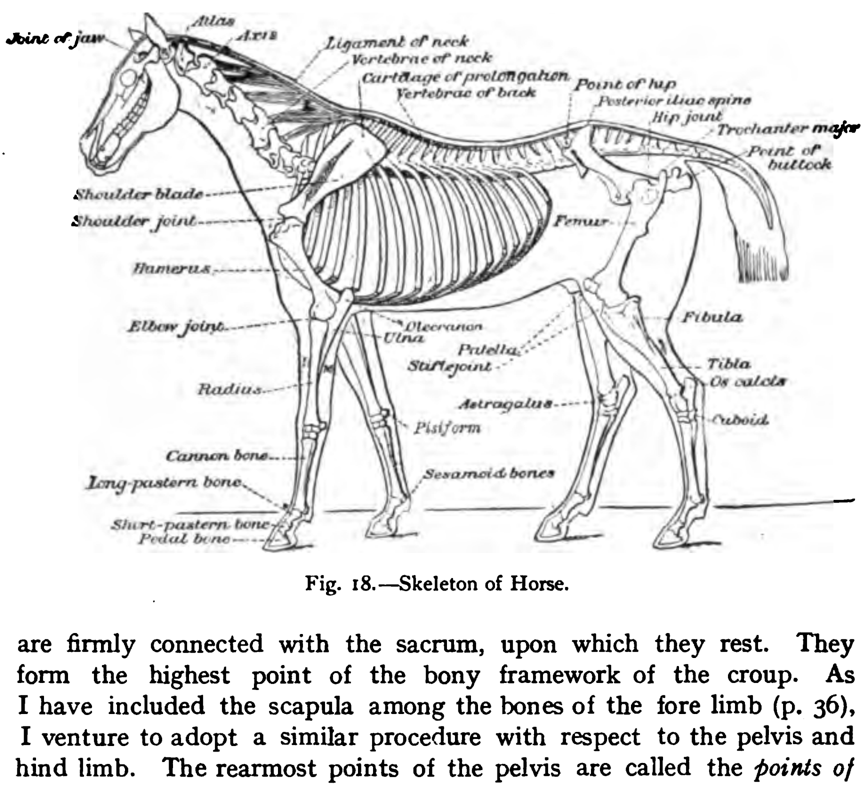


Fig. 18.—Skeleton of Horse.

are firmly connected with the sacrum, upon which they rest. They form the highest point of the bony framework of the croup. As I have included the scapula among the bones of the fore limb (p. 36), I venture to adopt a similar procedure with respect to the pelvis and hind limb. The rearmost points of the pelvis are called the *points of the buttock*.

The head of the thigh bone makes a ball and socket joint with the pelvis; while its lower end articulates with the tibia to form the stifle joint, in front of which the *patella* (knee cap) is placed. The patella serves for the attachment of muscles which extend the stifle joint, and is kept in position by strong ligaments. A portion of the thigh bone projects, from the outside, above the hip joint. The *tibia* articulates, at one end, with the thigh bone; and, at the other, with the *astragalus*, which is one of the bones of the hock. The part of the astragalus which makes a joint with the tibia, is formed like a pulley, the grooves of which have an outward and forward direction. The *os calcis* is placed behind the astragalus, and projects above it: its summit being called the *point of the hock. The small bones of the hock* are interposed between the astragalus and os calcis, and the cannon-bone and the two splint bones. The *fibula* is a vestigial bone, which is attached to the tibia, and which corresponds to the ulna of the fore leg. The patella has no analogue in the fore extremity. The bones below the hock are similar to those below the knee.

Analogies between the bones of man and the horse.—The horse possesses no collar-bone, consequently there is no bony connection between his fore extremity and trunk. The humerus, elbow, and fore-arm are the same in both, except that the ulna is complete in the horse, only in very rare instances. The knee of the horse corresponds to the wrist of man. The five bones between our wrist and the first row of knuckles are represented in the horse by the cannon and splint bones. His fetlock is analogous to the first row of knuckles of our hand. The long pastern bone corresponds to the first bone of our middle finger; the short one, to the second bone; the pedal bone, to the third bone; and the hoof, to its nail. The navicular bone has no counterpart in our frame. In the hind limb, the stifle represents our knee; the tibia, the shin; the hock, the ankle; the point of the hock, the heel; and so on. In man, the fibula is a fully developed bone. We may thus see that the horse is an animal which moves on the tips of his fingers and toes (unguligrade); and that he has only one complete and functional toe (or finger) to each leg. Some early ancestors of the horse had, like ourselves, five digits (fingers or toes) on all their limbs; these digits being respectively connected with the five bones that, in their present equine descendants, are represented only by the cannon-bone and the two splint bones. In the higher animals, the digits are numbered from within outwards. Thus, the thumb of our hand is termed the first digit; and the little finger, the fifth digit.

Joints and Ligaments.—Joints may be divided into those which admit of more or less motion, and those which are immovable. The ends of the bones which form them are, in both cases, held together by strong inelastic ligaments, of which there are various kinds. *Capsular ligaments*, for instance, loosely encircle their joints in order to protect the apparatus which lubricates the ends of the bones. *Lateral ligaments* are placed on each side of the joint, and, being attached both above and below it, keep the bones together, while often allowing considerable play. *Annular ligaments* form protecting sheaths for the passage of tendons; and *interosseous ligaments* bind bones closely together. Besides these, there are *suspensory* and *check ligaments*, which, as far as we are at present concerned, are respectively represented by the structures, bearing these names, which are found in the legs, below the knees and hocks.

The ligaments to which I have referred are, like tendons, composed of white fibrous tissue (a variety of connective tissue, p. 30), which is hard, strong, and inelastic. *Yellow ligaments* are, without going into minute differences, to be distinguished by the fact of their yellow colour, and by the possession of considerable elasticity, which enables them to passively bear weights which would otherwise fall on the muscles. A familiar instance of the manner in which elastic ligaments mechanically save the expenditure of muscular force, is afforded by the arrangement which keeps the claws of a cat retracted without entailing exertion on the animal; each claw being kept back by a small elastic ligament, which becomes stretched when the digits of the paw are extended by their muscles. As soon as these muscles cease to act, the ligaments, by their power of contraction, regain their natural length and draw in the claws. An enormously powerful elastic ligament is attached to the withers, and goes straight from them, in the form of a cord, to the top of the head (the bony prominence between the ears), to which it is inserted. At about a third of the distance from the head to the withers, a broad sheet of elastic tissue is given off from the corded portion, and is united to all the spines of the neck vertebræ, except the first. This sheet accordingly acts as a partition between the muscles on the respective sides of the upper part of the neck. The entire ligament, therefore, by its strength and elasticity greatly aids the muscles in supporting the weight of the head and neck. The amount of stretching which it can undergo in ordinary circumstances may be approximately estimated by comparing the length of the neck, when the head is held up in its usual position, to that when it is lowered to allow the animal to feed off the ground. In the first case, with a horse 15.3 high, it will probably not exceed 28 inches in length; but in the latter it must be over a yard long, supposing that the animal does not unduly bend his knees. Any depression or elevation beyond the position occupied by the head when the horse is asleep standing, has to be obtained by muscular force. This ligament is called the *ligamentum nuchæ*, or *suspensory ligament of the head and neck.* It is continuous with the strong, white fibrous ligament which commences on the spines of the sacrum and runs along the top of the spines of the vertebræ of the loins and back, binding them together, until it nearly reaches the summit of the withers, where its fibres assume the character of yellow elastic tissue. On its top there is a layer of fat, which in entires (especially if they are coarsely bred) often increases to a great size, and consequently gives them a high and thick crest (Fig. 312). The intestines of the horse are supported by the *abdominal tunic*, which covers the muscles of the lower part of the belly, and consists of a broad, strong sheet of yellow elastic tissue. It acts like an elastic abdominal belt.

There is considerable power of movement between the *head* and the first vertebra of the neck (the *atlas*), and between the different *neck vertebræ* themselves; but hardly any between the *dorsal vertebræ*. The *loin vertebræ* can be flexed and extended to a slight degree on each other; but are capable of only very little motion from side to side. The *sacrum*, as before mentioned, forms in the adult horse a single bone, on which the pelvis rests, and with which it is connected by powerful ligaments that greatly restrict its movements on the spine. We have also seen that the thigh bones articulate with the pelvis. The joints of the *tail* possess considerable mobility. The solid connection thus afforded to the hind limbs, with the trunk, enables the former to transmit to the latter the forward impetus given during progression with the least possible loss of power. The capability of the loins to be flexed and extended is necessary in order to facilitate the action of the loin muscles, which are important agents in locomotion (p. 67). The mobility of the head, neck, and, to a much lesser degree, of the tail, acting as they do as balancing poles, is extremely useful in enabling the animal to perform with ease and precision many of the varied and difficult movements demanded of him. We may see that any power of lateral motion which the trunk (not counting the head, neck and tail) may possess, however much it may make the horse quick and "handy" at turning, will militate against his speed in a forward direction.

The respective ends of the first eight *ribs* form movable joints with the spine and breast-bone; the first articulating with the last neck vertebra and first dorsal vertebra; the second with the first and second dorsal vertebræ; and so on. They are rigidly connected to their cartilages, of which those of the first eight, or true, ribs form movable joints with the breast-bone. Commencing from the spine, "the ribs pass outwards and backwards, and then in an arched direction downwards, their cartilages inclining inwards and forwards" (*Strangeways*). Owing to the peculiar manner in which the ribs are curved, and to the fact that the ends of the true ribs can pivot round in the joints which they form with the spine and breast-bone, while the false ribs also form movable joints with the spine; the capacity of the chest is capable of becoming much enlarged, when the middle portion of the ribs are pulled forward by muscles that are attached to them. The mobility of the ribs, which is all but absent in the first one, gradually increases as they go backwards. They also increase in rotundity in the same manner, the first one being the flattest. The first rib is the shortest, and each succeeding one is longer than the one next in front of it, till the eighth or ninth rib, the ribs behind which gradually decrease in length up to the last one, which is nearly as short as the first rib. Owing to the direct connection which the first eight ribs have with the breast-bone, their power of movement and, consequently, their action in increasing the capacity of the chest is less than that of the false ribs. Hence, when seeking for signs of good breathing power in a horse, we should attach far more importance to rotundity of the rear portion of the chest than of the front part. For practical requirements, the former region might, in the saddled horse, be regarded roughly as the portion of the ribs behind the saddle flaps, and the latter as that covered by them. "It can be proved by observation, that the middle false ribs are those which have the greatest power of being drawn forwards and outwards. The ribs behind them successively lose more and more their power of displacement up to the last one, the lower end of which can be raised and lowered a little, without appreciably altering its distance from the point of the hip" (*Colin*).

The *fore limb* is connected to the trunk by muscles, to which allusion will be made on pages 42 and 43.

The *shoulder joint* is a ball and socket articulation which possesses considerable power of motion.

The *elbow* is a hinge joint, which can be bent and extended.

In the *knee* we have three hinge joints, of which that between the radius and first row of bones is capable of a large amount of motion; that between the two rows, of much less; while that between the second row and cannon-bones, possesses hardly any power of movement.

The bones at the back of the knee are united together by an extremely strong ligament, one of the bands of which closes up the gap left between the point of the pisiform bone and the inside of the knee, so as to form a channel for the "back-tendons" to pass through.

The *sesamoid* bones are fixed immovably to the back of the fetlock joint.

The *fetlock, pastern,* and *pedal* (*coffin*) joints are hinge joints, which possess more or less play.

The *hip joint,* formed by the head of the thigh bone and cavity in the pelvis, is a ball and socket joint.

In the *stifle* we find two articulations—one with the thigh bone and tibia, the other with the thigh bone and patella, which is firmly attached to the tibia by ligaments, in order to enable it to resist the action of those muscles of the thigh which are inserted on it.

The *true hock joint* is formed by the tibia and astragalus. It is a hinge joint, which, owing to the oblique manner its grooves are placed, causes the foot to be turned slightly outward when the joint is either flexed or extended. The other joints of the hock possess hardly any power of movement.

The *astragalus*, *os calcis*, *small bones of the hock*, *hind cannon bone*, and *splint bones* are firmly connected together by ligaments.

The *joints below the hock* are similar to those below the knee.

Muscles.—The principal muscles which are used in locomotion will now be briefly considered.

A broad sheet of muscle (the *panniculus*) lies immediately underneath the skin that covers the neck, sides of the chest, and abdomen. In thin horses, its rear border is usually defined by an irregular line (p. 355) which runs along the side downwards and backwards towards the groin. This muscle is attached, round its borders, to the skin and superficial muscles by sheets of fibrous tissue. By quickly contracting and relaxing alternately, it causes the skin to twitch, and thus gets rid of flies, etc., that may have alighted on the surface underneath which a portion of this muscle lies. It is principally found on those parts which the horse has difficulty in reaching with his lips, tail, or mane. As the process of training for racing purposes appears to largely develop this muscle, I cannot help thinking that it aids in forced expiration—expelling the air from the lungs—during the quickened breathing entailed by fast work; although writers on anatomy do not ascribe this action to it.

The *neck, back, and loins are flexed* by muscles which lie immediately underneath the spine. The *head is bent* by muscles that proceed—one on each side—from the breast-bone to the lower jaw, and by others which connect the neck and head together. The *head is extended* by muscles that are attached to the poll and bones of the neck and by others that proceed from the poll to the withers. The *neck is extended* by the last mentioned muscles, and by those which connect the spine of one vetebra with the body of the one in front of it. The *back and loins are extended* by muscles which are similar in action to the one just alluded to, and by the *longissimus dorsi*, which is the most powerful muscle of the body, and is the chief extensor of the spine. It forms the principal portion of the fleshy mass which lies over the loins and back. It is attached to the pelvis, sacrum, all the loin and dorsal vertebræ, the last four bones of the neck, and to the ribs. As the spines of the vertebræ (including the withers) form a part of its attachments, it follows that the more they are developed, the more powerful will be the extension of the loins and back.

Muscles which connect the fore limb to the body.—The shoulder-blade is connected to the trunk principally by a very strong, fan-shaped muscle (*serratus magnus*), which is attached at its middle to the inside of the shoulder-blade. Its front end is connected to the last five bones of the neck; and its other end to the first eight ribs. Some anatomists call its anterior portion the *angularis muscle of the scapula* (*levator anguli scapulæ* of man). When the front portion contracts, the shoulder-blade is drawn forward; when the rear portion contracts, this bone is pulled back. This muscle, from the manner of its attachment, acts as a sling for the fore limb. *The upper part of the shoulder-blade is connected to the trunk,* from its inner extremity by a muscle which has one end attached to the suspensory ligament of the head and neck, and the other to the withers. Hence, on contracting, it draws the shoulder-blade forward and upwards. *The outside of the shoulder-blade is connected* to the trunk, at about its upper third, by a muscle which has one branch going to the withers, and the other to the suspensory ligament of the head and neck. It can thus raise the shoulder-blade, or work it backwards or forwards. *The fore limb is drawn forward* chiefly, however, by the action of a muscle (*levator humeri*) which is attached, at one end, to the top of the head and first four neck vertebræ, and by the other to the middle of the humerus. We may see from the foregoing remarks, that length of neck and height of withers are favourable conditions for the firm attachment of the shoulder-blade to the trunk and for the free action of the shoulder.

The fore limb is connected to the breast-bone by a muscle which is attached to the breast-bone and humerus.

The fore limb is drawn back, principally, by two muscles, one of which is attached, at one end, to the abdominal tunic (p. 40) and breast-bone; and at the other, to the humerus and shoulder-blade, close to the shoulder joint. The other muscle (the *latissimus dorsi*) has its origin on the vertebræ of the loins and back, and is inserted on the humerus, which it consequently draws backwards and upwards when it contracts. The first mentioned muscle tends to draw it backwards and downwards.

Muscles of the fore limb.—When a fore leg is advanced, the shoulder joint is extended and the elbow joint flexed. When it is drawn back, the opposite to this takes place. Agreeably to these actions, we find a powerful muscle (*flexor brachii*) attached, by one end, to the front part of the shoulder-blade, just above the joint; and by the other end to the front of the radius immediately below the elbow joint, so that, when it contracts, it *extends the shoulder and flexes the elbow.* Another muscle, being attached to the rearmost corner of the shoulder-blade and to the point of the elbow, *flexes the shoulder and extends the elbow.* Besides these muscles, there are various others which respectively aid in the flexion and extension of these joints. The chief muscle that *extends the knee* has its origin on the front part of the humerus, just above the elbow joint, and running down the fore-arm, is joined to its tendon, which passes over the knee, and which is inserted on the head of the cannon-bone. The three muscles which *bend the knee* take their origin on the back part of the humerus, just above the elbow joint, and are inserted on the pisiform and splint bones. The two muscles which *extend the fetlock, pastern and pedal joints,* run down the front of the fore-arm. One of them has its origin at the head of the radius, and is inserted on the front part of the long pastern bone. The other commences on the humerus, just above the elbow joint, and ends on the front and upper part of the pedal-bone. *The muscles which flex the fetlock, pastern, and pedal joints* (*the flexor muscles of the foot*) and aid in bending the knee, take their origin on the back part of the humerus, just above the elbow joint, and proceed down the back of the fore-arm. A little above the knee they are joined to their tendons (the *back-tendons*), which pass through the sheath formed by the pisiform bone and the annular ligament at the back of the knee. From there they run down the back of the cannon-bone. The front one, which lies next the suspensory ligament, goes over the sesamoid bones, which form a pulley for it; down the back of the pastern; over the navicular bone, which also acts as a pulley; and is finally inserted on the base of the pedal-bone. The rearmost tendon, which lies between the front one and the skin, forms a sheath for its fellow at the back of the fetlock, and, dividing in two, is inserted on the short pastern bone. There are two short muscles which assist the front one of these two muscles, but which need no further allusion. As the action of the suspensory and check ligament is closely connected with that of the flexor muscles of the foot, it is appropriate to describe them here. The *suspensory ligament* lies at the back of the cannon-bone and between the two splint bones. It has its origin at the head of the cannon-bone and lower row of the small bones of the knee. At about two-thirds of the distance from the knee to the fetlock, it divides into two branches, which are respectively inserted on the summits of the sesamoid bones. They then extend downwards and forwards, and unite together, at the front and about the middle of the pastern, with the tendon of the muscle which extends the foot. The suspensory ligament is composed of white fibrous tissue, with a few muscular fibres in it, and acts in supporting the fetlock. It is generally considered to be inelastic, although Goubaux and Barrier entertain the opposite opinion. They remark that "its obscurely muscular structure, and the manner in which its fibres intercross, render it a true elastic brace, which counteracts the effect of weight, as long as they do not overcome the resistance and strength of the tissues." In omnivorous and carnivorous animals this ligament is represented by a muscle which has similar functions. The *check ligament* has nearly the same origin as the suspensory ligament and joins the front back-tendon, at a point about half-way down the cannon-bone. Its office is to aid in supporting the fetlock and to relieve the muscles of the tendon, with which it is connected, of weight.

Muscles of the hind limb.—The *hip is extended* by the great croup muscle, and also by muscles which lie at the back of the thigh bone. One end of the great croup muscle (*gluteus maximus*) is attached to the upper surface of the front portion of the pelvis, and, proceeding along the side of the sacrum, reaches as far as the last rib. The other end is inserted on the summit of the portion of the thigh bone which projects above the hip joint. The muscles at the back of the thigh bone have their origin, chiefly, on the under surface of the pelvis, from behind the hip joint to the point of the buttock; and are inserted principally to the lower part of the thigh bone or to the upper portion of the tibia.

The *hip is flexed* by muscles that have their origin on the under surface of the loin vertebræ, and are inserted on the thigh bone; and also by muscles which are attached to the under surface of the pelvis in front of the hip joint, and to the thigh bone, patella, or tibia.

The *stifle is extended* by one muscle which has its origin on the under surface of the pelvis, just in front of the hip joint, and is inserted on the patella, and by two others which are attached to the upper part of the thigh bone and to the patella. The first mentioned muscle (*anterior rectus*) flexes the hip at the same time that it extends the stifle.

The *stifle is flexed* chiefly by a muscle which is attached to the portion of the pelvis behind the hip joint, and to the tibia.

The *hock is extended* chiefly by two muscles (*gastrocnemii*) which form the rearmost portion of the gaskin. They have their origin on the lower end of the thigh bone, and are inserted on the point of the hock by their tendons, which lie one over the other, and constitute the *tendo Achillis*. The underneath tendon terminates at the point of the hock; but the other is continued down the back of the leg as the rearmost one of the two back tendons, and is inserted on the short pastern bone, as in the fore limb. Owing to the double insertion of this tendon, the hock cannot be extended without the fetlock being flexed at the same time; hence the success of the plan, for the prevention of kicking, of securely fixing in the hollow of the pastern some hard object of suitable shape, so as to prevent the joint between the two pastern bones from becoming flexed. Extension of the stifle causes extension of the hock.

The *joints below the hock are extended* by muscles which take their origin near the stifle joint, run down the front of the hind leg, are continued as tendons down the front of the cannon-bone, and are inserted on the bones of the pastern, and to the front and top of the pedal bone.

The *joints below the hock are flexed* by a muscle of the gaskin, which muscle originates at the back of the upper portion of the tibia, behind which it runs down to a little above the hock joint, when it is continued as a tendon that passes over the groove formed on the *os calcis*. It then proceeds down the back of the cannon-bone, as the front one of the two back-tendons, and terminates in the same manner as in the fore limb. The muscle of the rear back-tendon, as we have already seen, also aids in flexing the fetlock and pastern joints.

Heart and Lungs.—The heart is a hollow muscle which acts as a force pump in sending the blood through the *arteries* to the various parts of the body. The arteries commence on the left side of the heart, by one large trunk, which splits up, as it goes on, into an innumerable number of small branches, that, as a rule, terminate in a microscopic network of minute canals called *capillaries*. These canals, which probably do not exceed a fortieth of an inch in length, gradually enlarge on the side away from the arteries, and open out into small *veins*, which, uniting with each other as they approach the heart, enter its right side by two large branches and a few small ones. The heart now forces this venous blood through the pulmonary artery to the lungs, which return it by a system of capillaries and veins to the heart. We must remember that the network of *capillaries* runs through every tissue which contains blood. Thus, for instance, the blood which goes to the foot of the horse, and that which proceeds to the substance of the heart itself, flow to their respective parts through certain arteries, pass through a very short network of capillaries, and return to the heart by veins; a long circuit being made in the first case; a short one, in the second.

The necessary amount of nutritive matter and water is taken up from the food and drink contained in the stomach and intestines by small vessels which carry it into the veins, and is thus finally brought into the capillaries, the walls of which are so thin that it exudes through them, and in this manner nourishes the various tissues. Before food can be taken up by the system, it is necessary that it should be thoroughly dissolved. As the tissues are being constantly broken up as well as repaired, a system of vessels, called *lymphatics*, take up the waste matters and carry them into the veins. When this impure or venous blood is pumped by the right side of the heart into the lungs, it is acted upon, there, by the oxygen of the air that is taken into the chest at each breath, and is returned from the lungs to the left side of the heart in a comparatively high state of purity. When the blood leaves the lungs, it carries with it a certain amount of oxygen, which, uniting with the broken-up material in the various tissues, converts it into products which can be readily removed.

In order that a muscle may work—*i.e.*, contract on being stimulated by its nerves—it is necessary that it should be supplied with oxygen. Also, the severer the labour, the more oxygen is used up in the muscles and the larger is the supply required. As the blood has a shorter distance to travel in order to make a complete circuit in the blood vessels of a small animal, than in those of a large one of the same kind; we may infer that the blood of the former passes more frequently during a given space of time through the lungs, than that of the latter. The truth of this supposition is fully borne out in practice; for we may observe, on an average, that the pulse of a heavy cart-horse beats about thirty-five times a minute; that of a small pony, about forty-five times. Hence we find that, speaking generally, small horses can "stay" better than large ones; for the power of "staying" is dependent on the capability possessed by muscles, of retaining for a long time their contractile power. Also, they recover quicker than big horses from the effects of severe work, owing to the fact that repair of worn-out tissue and removal of waste matters from the system is carried on at a faster rate. In fact, they possess more "vitality." Again, the larger the lungs —other things being equal—the greater will be the amount of oxygen taken into the blood, and of impurities given off from the blood into the air.

Nervous System.—The nervous system of the horse is the power which stimulates and directs the action of his muscles, and is the source of his mental capacity. We may divide it into *nerve centres* and *conducting nerves*. To employ a well-worn simile, we may look upon a nerve centre as a telegraph station to which and from which messages are sent and dispatched. The nerves (*sensory nerves*) by which the horse sees, feels, hears, smells, and tastes, conduct the impressions they receive to some nerve centre, which may do one of three things. (1) It may, in response to the message received, send, on its own authority, by another line of nerves (the *motor nerves*), an order (stimulus) to certain muscles to move. Such a movement will be by *reflex action*—that is, the impulse will be immediately reflected back. (2) Instead of acting on its own account, it may merely transmit the message to another and more important nerve centre to decide what answer will be given. (3) It may use a portion of its transmitting power in reflex action, and a part of it in reporting the matter to head-quarters.

Besides the power which nerve centres have of exciting the muscles to move in response to a stimulus received from the sensory nerves, they can, by their own initiative, make their motor nerves stimulate to movement the muscles which are supplied with these particular motor nerves.

The chief nerve centres that are connected with the muscles of locomotion, are grouped together in a long column which fills the brain cavity, and spinal canal, and may be divided into the *brain* and *spinal cord*.

The *spinal cord*, though it is formed of a number of nerve centres, is the chief conducting medium by which impressions received by the senses are conveyed to the brain, and is the means by which orders from the brain are transmitted to the muscles of the limbs.

We may divide the brain into the medulla oblongata, the cerebellum, and the cerebrum.

The *medulla oblongata* connects the two other portions of the brain with the spinal cord. It is the nervous centre of the function of breathing. Animals, for purposes of experiment, have had their spinal cord and the whole of their brain, except the medulla, removed, and yet they have continued to breathe and live. But when the medulla is injured, death from inability to breathe, at once ensues.

The *cerebellum* is the organ of *muscular sense* and of combined muscular effort. By its muscular sense an animal can tell, from experience, the amount of muscular force required in performing its various voluntary movements. We cannot, by an effort of will, move any one particular muscle of our body; but we can cause our limbs to perform definite movements which require the combined action of various muscles, and which are under the control of the cerebellum.

The *cerebrum* is the organ of intellect, thought, and will. "Removal of the cerebrum in the lower animals appears to reduce them to a condition of a mechanism without spontaneity. A pigeon from which the cerebrum has been removed will remain motionless and apparently unconscious unless disturbed. When disturbed in any way, it soon recovers its former position. When thrown into the air it flies" (*Kirkes' Physiology*). The cerebrum appears to be the organ in which a conclusion or thought is formed from a message or a number of messages proceeding from the senses. If, for instance, a man standing near a horse's hindquarters touches him with a stick, and if the animal kicks the stick, he will perform, more or less, a reflex action. If, however, the horse recognises who the real offending party is, and kicks the man, he will have drawn a conclusion from the message received from his sense of feeling and of sight, and will have acted on such conclusion, which would be, more or less, an effort of reason.

Among the intellectual faculties, of which the cerebrum is the special organ, we have, prominently, *reason* and *memory*. Although the horse is greatly deficient in the former, which is by far the higher faculty of the two, he possesses the latter in special excellence.

The cerebrum is placed immediately underneath the forehead, at the centre of which it is covered by only a thin plate of bone. The cerebellum, which is a great deal smaller than the cerebrum, lies below the top of the head (occipital crest), when the face is held at an angle of about 45° with the ground.

The proportion which the weight of the brain bears to that of the spinal cord, is a fair guide to the intellectual capacity of an animal. The following is a list of the average number of times the brain is heavier than the spinal cord in certain animals, and it agrees fairly well with the conclusions drawn from practical experience :—

In man	33
„ dog	5.14
„ cat	3.75
„ ass	2.40
„ pig	2.30
„ horse	2.27
„ ox	2.18

Teeth.—As horses' teeth have been described and illustrated in *Veterinary Notes for Horse-Owners*, allusion will be made to them, here, only with the object of explaining certain references to this subject in the chapter on "The Evolution of the Horse."

A horse's teeth are usually divided into front-teeth (*incisors*), tushes (*canine teeth*), and back-teeth. At first there is a milk dentition, generally, of 3 incisors and 3 back-teeth on each side of each jaw; making a total of 24 milk-teeth. Between the ages of 10 months and 5 years, the milk incisors and milk back-teeth become replaced by permanent teeth, tushes spring up in male horses, and 3 more back-teeth make their appearance behind the first 3 back-teeth on each side of each jaw; the total being 40. The first 3 back-teeth are called *premolars*, and the second 3, which are not preceded by milk teeth, are termed *molars*. Occasionally in the upper jaw, but very seldom in the lower jaw, there are 4 premolars, in which case the 1st premolar is very small, and is usually called a "wolf's tooth." It is always present in the young fœtus. As the early ancestors of the horse had 4 premolars, this premolar is evidently a vestigial tooth. In the mare, the tushes are absent, or only in a rudimentary form. The teeth are numbered from the front backwards.

The body of a tooth is composed of an ivory-like substance (*dentine*), which is covered by a layer of very hard material (*enamel*), by means of which the animal cuts and masticates his food. On the cutting surface of the incisors, the enamel forms a depression (becomes "cupped"), and thus gives rise to the "mark." The cupped condition of the enamel greatly increases the cutting power of the teeth. There are two depressions in each of the back teeth. The enamel is covered by a layer of *cement*, which is nearly similar in structure to bone. The cutting surface of a tooth is called the *table;* and the portion of the tooth outside the gum, the *crown*.

Taking one side of both jaws and allowing for the appearance of a 1st premolar, the horse's dental formula is :—

$$\text{Incisors } \tfrac{3}{3} \quad \text{Canines } \tfrac{1}{1} \quad \text{Premolars } \tfrac{(4)\ 3}{(4)\ 3} \quad \text{Molars } \tfrac{3}{3} = (44)\ 40.$$

CHAPTER V.

MECHANISM OF BREATHING.

THE body of the horse (Fig. 19), viewed apart from his head, neck, limbs, and tail, may be divided into chest and abdomen (belly), the former containing the lungs and heart; the latter, the stomach, intestines, liver, bladder, and other vital organs. This division is effected by a broad and somewhat bell-shaped muscle (the *diaphragm* or *midriff*), which is attached, round its margin, to the ends of the last twelve ribs, to the rearmost extremity of the breast-bone, and to the spine under the loins; while its apex or centre projects forward. When it contracts, it tends to become flat, and thus enlarges the capacity of the chest by pushing back the contents of the abdomen. Its action, especially during forced breathing, is aided by that of another muscle, which is attached by one end to the last four neck vertebræ, and by the other to the first rib, which it pulls forward on contracting, and in this manner helps to increase the size of the chest.

Air is taken into, and expelled from, the lungs by means of the alternate increase and diminution of the capacity of the chest. When the former act occurs, the air contained in the lungs becomes rarefied, and consequently the external air rushes in through the animal's nostrils to restore the balance of pressure. When the latter takes place, a portion of the air which is already in the lungs is forced out. It is evident, therefore, that the power of taking a large volume of air into the lungs at each breath, is more dependent on the difference between the respective capacities of the chest when expanded, and contracted, than on the actual size of the chest itself.

The act of breathing is called *respiration;* that of expelling air from the lungs, *expiration;* and that of drawing it in, *inspiration.*

The capacity of the chest is enlarged by the diaphragm, as we have seen; and also by muscles which pull the middle pieces of the ribs forward, so as to make the cavity wider from side to side, and consequently to increase its size. The ribs are drawn forward by muscles which cover them, and by others which are situated between the successive pairs of ribs. The lower ends of some of the ribs are also drawn up during the act of inspiration. On page 40, I have remarked on the power the ribs have of pivotting on their ends. When the air which is within the chest, becomes rarefied at the commencement of the act of inspiration, the lungs passively dilate, and thus allow the incoming air to gain ready access to the bronchial tubes and air-cells.

When the animal is at rest, the elastic recoil of the ribs and lungs is sufficient to expel the *tidal air*, as the amount changed at each breath is called. The volume of air which remains in the lungs

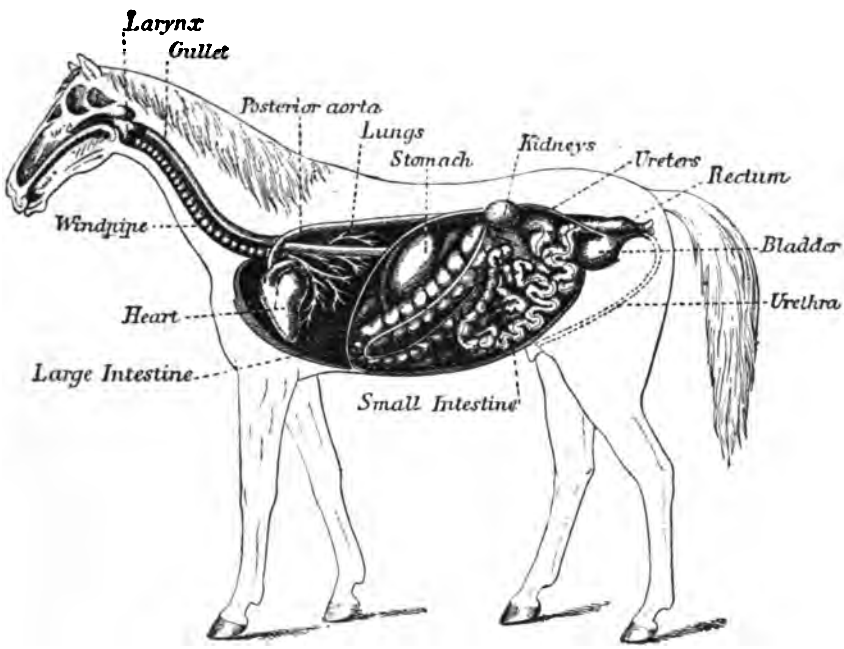


Fig. 19.—Internal Organs of Horse.

after expiration, greatly exceeds—perhaps five or six times—that of the tidal air.

In *forced breathing*, as during active movement, several muscles which are not employed for tranquil respiration are called into play, particularly those used in forced expiration, as we may see by the heaving flanks of an animal which is "blown." The muscles which cover the ribs and belly, aid in forced expiration by compressing these parts, and thereby causing the walls of the chest to "fall in," and the contents of the abdomen to project forward into that cavity. Quick work naturally developes the muscles of forced respiration.

The muscles of the flank (known to anatomists as the great and small oblique, and the transverse) aid in respiration. Consequently, when they are well developed, the flank is not so hollow as it would be if they were wanting in size.

No hard and fast line can be drawn between tranquil and forced breathing; although the broad differences between them are clearly marked.

In order that the horse may have his breathing power fully developed, it is necessary that the capacity of the chest at the end of an act of expiration, should differ as much as possible from what it will be at the termination of the act of inspiration. For this reason the chest should be deep, the ribs well arched, and, at the same time, they should have a good inclination to the rear. The back ribs should be long, so as to augment the size of the chest; and the muscles which move the ribs, as well as the muscles of the belly, should be largely developed. Further allusion will be made, in Chapter XVII., to the shape of the chest and ribs.

CHAPTER VI.

DISTRIBUTION OF WEIGHT IN THE HORSE'S BODY.

Comparative Weight borne by the Fore and Hind Limbs—Centre of Gravity.

Comparative Weight borne by the Fore and Hind Limbs.—General Morris, of the French Army, appears to have been the first to make experiments as to the distribution of weight between the fore and hind limbs of the horse. He found that, taking one animal with another, it is as five is to four; and that the fact of the neck being long, as in the thorough-bred, causes more weight to be thrown on the fore-hand, than when that part is short and massive, as in the heavy cart-horse. The proportion which he obtained from an average of eleven horses that had light heads and necks—the latter being presumably long—was as four is to three. Colin puts the average at fully three to two. Goubaux and Barrier have proved by a number of careful trials, that the lower the withers are, as compared to the croup, the greater is the proportion of weight supported by the fore limbs; and *vice versâ*. As the hind half of the trunk is, in all classes, heavier than the fore half, it follows that the extra weight in front is mainly due to the fact of the head and neck being in advance of the fore legs. The longer the body, and the heavier the belly, the more will this distribution of weight be equalised.

Centre of Gravity.—The centre of gravity of a body is an imaginary point in that body, so placed that if the body be supported immediately underneath the centre of gravity, it will be in equilibrium (rest). Consequently, if a body be balanced at a point on its surface, a vertical line drawn from that point will pass through the centre of gravity; and the intersection of two or more such lines will determine the position of the centre of gravity. If the body be of uniform density, the position of the centre of gravity will be the same as that of the centre of the figure; but if it be heavier at one side than at the other, the centre of gravity will be nearer the former than the latter. For instance, in ships, with the view of obtaining increased security from an upset, the centre of gravity is placed below the centre of the hull. If, for example, we want to ascertain the position of the centre of gravity of a loaded club, we may take one line through its axis, and another across it, at the point where it balances, when placed horizontally. The lower the centre of gravity of a body, the more stable will be its equilibrium, as we may see by experimenting with a loaded stick of uniform thickness; firstly, balanced on its light end, and, secondly, on its heavy extremity.

In the living animal, the position of the centre of gravity is constantly

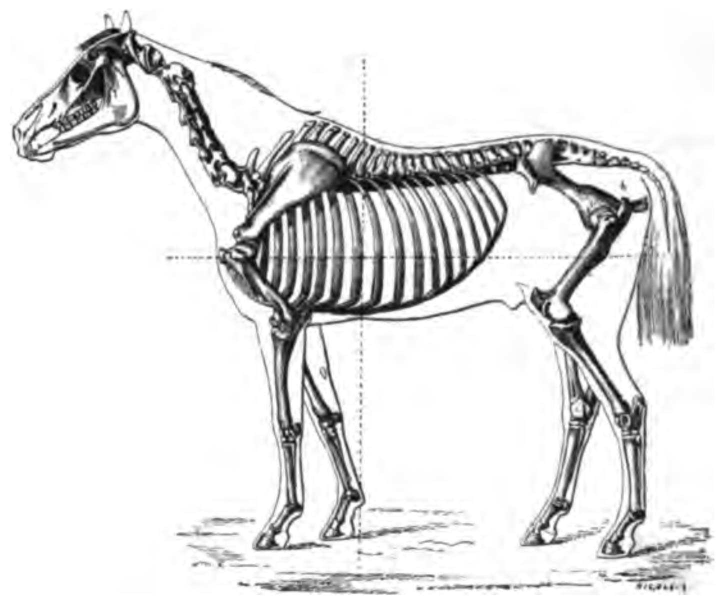


Fig. 20.—Position of Centre of Gravity. (From Goubaux and Barrier's *L'Extérieur du Cheval.*)

changing, on account of the manner in which the respective positions of the various parts alter, especially during movements of the head and neck.

Colin, the well-known author of *Physiologie Comparée des Animaux Domestiques*, remarks that "the centre of gravity, the exact position of which has never been determined, nearly corresponds, in the horse, to the intersection of two lines—one, vertical, falling behind the xiphoid appendage [cartilage at rearmost point of the breast bone] of the sternum; the other, horizontal, dividing the middle third from the lower third of the body." Fig. 20 is drawn in conformity with Colin's remarks. The point of intersection of the two dotted lines in this figure, shows the position of the supposed centre of gravity.

We may readily see that the less deep is a horse's body, compared to his length of leg—in other words, the more " daylight " he has under him—the higher and more unstable will be his centre of gravity; and *vice versâ*. Taking the foregoing remarks with those on the effect which instability of equilibrium has on speed (p. 69), we may conclude that the faster the horse, other things being equal, the greater will be the proportion of weight on his fore-hand.

CHAPTER VII.

LEVERS.

Definition—First Order—Second Order—Third Order—Relations between the Power and Weight in Levers—Comparisons between Power and Weight in Muscular Levers—Directions in which the Power and Weight respectively Act.

THE movements of the limbs are due to the working of various levers, formed by bones and acted upon by muscles.

Definition.—A lever is a bar which has a *fulcrum*, or fixed point, so arranged that movement can be communicated to a *weight* at another point on it, by a *power* acting on a third point on the bar. Agreeably to the relative positions of the fulcrum (F), weight (W), and power (P), we have the three following orders of levers.

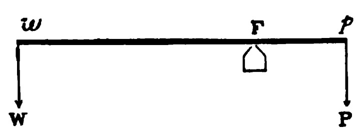


Fig. 21.—First Order of Lever.

First Order.—P.F.W. (Fig. 21), as when two persons make a see-saw by sitting on the opposite ends of a plank which rests on some convenient fulcrum. We have this order of lever in the bones from the point of the hock to the foot, when a horse kicks out with a hind leg (Fig. 46).

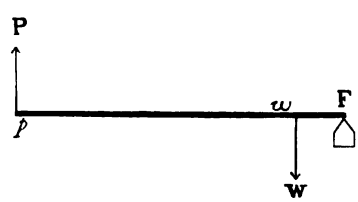


Fig. 22.—Second Order of Lever.

Second Order.—P.W.F. (Fig. 22). A wheel-barrow, when lifted in the usual manner, furnishes us with an instance of this lever;

the ground on which the wheel rests being the fulcrum; the barrow, the weight; and the arms of the person who lifts the handles, the force. We have another example in an oar employed to row a boat; the water being the unstable fulcrum, and the rowlock being the point through which the weight (the boat) is pushed forward. The bones and muscles which have been taken to illustrate the first order of lever will serve our purpose here, if we imagine the power to be exerted in propelling the body to the front, through the *tibia* (the bone that is situated between the hock and stifle), while the toe rests on the fulcrum formed by the ground (Fig. 47).

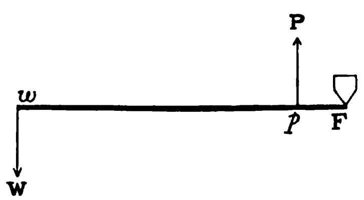


Fig. 23.—Third Order of Lever.

Third Order.—W.P.F. (Fig. 23). This form of lever occurs in a fishing rod, with which a man tries to lift a heavy trout out of the water. The weight is at the point of the rod; the fulcrum, at the butt, is formed by one hand; and the power is supplied by the other hand, a little above the butt. We have this lever in the bones below the hock, when the horse bends that joint by lifting his foot off the ground (Fig. 48). Here, the power is derived from the muscle which is placed in front of the *tibia;* the weight is that of the limb below the hock; and the fulcrum is formed by the *tibia.* The *os calcis* does not come into this lever, except in counterbalancing, to a very slight extent, the weight of the leg below the hock.

Relations between the Power and Weight in Levers.—The farther the power is from the fulcrum, the greater will be the mechanical advantage at which it will act; and *vice versâ.* Thus, if one arm of a see-saw is longer than the other, a comparatively light weight at the end of the former will counterbalance a heavy one at the extremity of the latter. Also, the longer an oar is "in-board," as in an outrigger, the greater will be the power which a rower will have. If we apply this principle to the horse, we shall see that the longer is the *os calcis* (Figs. 46 and 47), the greater will be the mechanical advantage at which the muscles of the gaskin will act in kicking or in propelling the body forward. As length of *os calcis* gives increased leverage in the hind limb, so does length of *pisiform* afford it in the fore leg.

If we wish to express these relations mathematically, we have the following proportions for the three orders of levers:—

$$P : W :: w F : p F, \text{ or } \frac{P}{W} = \frac{w F}{p F}$$

Here, w F is the distance of the point of application of the weight from the fulcrum; and p F, the distance of the power from the fulcrum.

Comparisons between Power and Weight in Muscular Levers.—We may observe that the power always acts at a mechanical disadvantage in levers of the third order. As the majority of the levers which are used in animal locomotion, act at a mechanical disadvantage; I shall now investigate the cause of this apparent anomaly, and may first remark that the measure of work done by a force is found by multiplying the weight by the distance through which it has been moved. Thus, suppose two men are engaged in raising weights, one having a single block pulley to lift a weight of 25 lbs., while the other, to raise 100 lbs., uses a multiplying block which increases the power fourfold; the former will raise his 25 lbs. 4 ft. off the ground in the same time and with the same expenditure of force as the latter will lift his 100 lbs. to a height of 1 ft. In fact, what is gained in power is lost in distance. This law holds equally good with levers, as we may see from the fact, for instance, that a small amount of contraction of the muscle which bends the hock, causes the hind foot to move through a considerable space. Were the hock bent, for example, by a muscle that had its two points of attachment at the stifle and fetlock (instead, as is actually the case, at the stifle and a little below the hock), such muscle would act at far greater mechanical advantage than the present flexor of the hock; but it could not bend that joint to anything like the same extent, because muscles cannot contract to more than about two-thirds of their normal length. Besides, such an arrangement would be extremely inconvenient for every-day work, and would increase the liability of the limb to injury. Although there is, therefore, a very large expenditure of muscular force in the action of the levers of the limbs; there is an equally large gain in flexion and extension, and consequently in speed. Their arrangement, also, enables the body to be made of a compact form, and to be suited to its surroundings.

Directions in which the Power and Weight respectively Act.—In the theoretical levers which have been given (Figs. 21, 22, and 23), I have assumed that the power and weight act at right angles to the lever, and that they are consequently parallel to each other.

In the actual levers (those of the hock) which have been taken into consideration, we can see that this is not the case. Also, the nearer a force is to being at right angles with its lever, the greater is the mechanical advantage at which it will work. If, in a lever of the first order, for instance, we have the power and weight, as in Fig. 24, acting in directions which are not parallel to each other, such forces (if the lever be in equilibrium) will then be inversely proportionate to the length of the perpendiculars drawn, from the fulcrum, to their respective directions. Thus in Fig. 24 we have P : W : : F *d* : F *e*. We therefore see that W, which is nearly at right angles to *a b*, acts much more advantageously than P, which is in a much more oblique direction to it. This would be equally true in the other two kinds of levers.

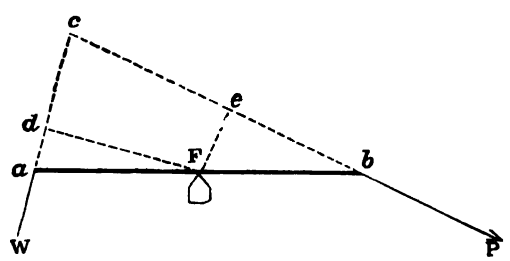


Fig. 24.—Lever of First Order with directions of Power and Weight oblique to each other.

The foregoing well-known mechanical law need not here be proved; as its solution can be found in any book on elementary statics.

Acting on the principle just enunciated, the cart-horse, with the view of obtaining the utmost mechanical advantage, when trying to draw a heavy load, will naturally endeavour to move the levers of his limbs (when straightening them out) with the power, as nearly as possible, at right angles to each respective lever. Hence he will obtain his best results by only slight bending of the joints, and consequently his steps will be short. This action of the levers of the hind limbs is well shown by the manner in which he will crouch down behind, when he makes a strong effort with his hind legs while exerting the fore legs but little, as may occur when the roadway is slippery. The galloper, on the contrary, will require the power of straightening out his limbs to their utmost extent (p. 66), and will thus obtain speed at a lavish expenditure of muscular effort. This is especially well shown in the action of the fetlock joint (Fig. 45); for if the pastern be long and sloping, the mechanical disadvantage will be great, but the gain in speed will be equally large. If the pastern be upright, the fetlock will work advantageously as far as the weight to be moved is concerned; but it will contribute little to the attainment of speed.

CHAPTER VIII.

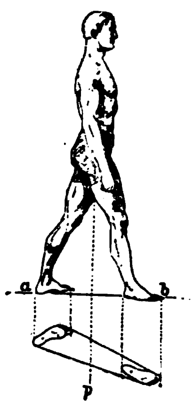
MECHANISM OF EQUINE LOCOMOTION.

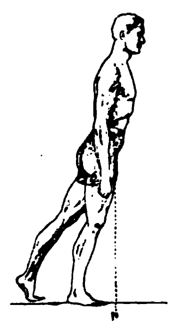
Displacement of the Centre of Gravity—Manner in which Propulsion is Effected by the Limbs—Direction of Propulsion, and Distance through which the Centre of Gravity of the Body is moved—Comparative Speed in the Action of the Limbs—Action of the Muscles which extend the Vertebræ—Width between each respective Pair of Legs as affecting Speed—Effect of Insecurity of Equilibrium on Speed—Fatigue from the various Paces—Action of the Head and Neck in Locomotion—Mechanism of the Fetlock Joint—Mechanism of the Hock Joint.

THE remarks made under this heading should be taken in connection with those in the following five chapters. Some observations which are given here, are necessary for an explanation of the movements of the horse in his various paces; but others, in order that they may be understood, have been kept back, until the nature of the paces and the mechanism of draught have been discussed.

Displacement of the Centre of Gravity.—Locomotion is effected by the advancement of a limb in order to bring a new base of support under the centre of gravity. Let us suppose that the man represented in Fig. 25 is standing with one foot advanced more than the other. His base of support (*a b*) will then be the area bounded by his feet and the lines joining them at each side. As long as the perpendicular (*p*) dropped from the centre of gravity falls within the base of support, the equilibrium of the body will be maintained. If the man, in this example, brings the centre of gravity of his body forward by straightening his left ankle joint, so that the perpendicular from the centre of gravity shall fall beyond the base of support (Fig. 26); it is evident that in order to prevent the body from falling, he will have to bring the rear leg (which in this case is the left one) beyond the perpendicular dropped from the centre of gravity (Fig. 27). Precisely the same actions take place when the horse starts from the halt into the walk; for by the straightening of one or both hind legs, he brings the centre of gravity of his body beyond the toe of the most advanced fore foot, with the result that the other fore leg has to be carried forward in order to restore the equilibrium. In doing this, the first foot to quit the ground will usually be a fore one. A succession of these displacements and recoveries by a man will constitute the walk, run, or other pace. Similar movements occur when leaping, except when the spring is made vertically upwards from a state of rest, in which case the centre of gravity is not displaced beyond the base of support.

Manner in which Propulsion is Effected by the Limbs.—Displacement of the centre of gravity, in the propulsion of the body, is accomplished by the straightening out of the limb or limbs,





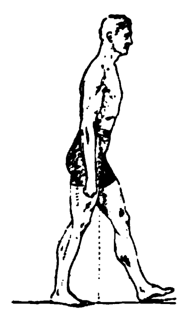


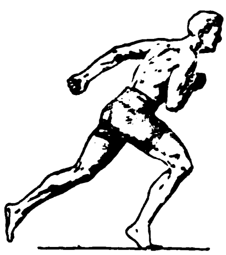
Fig. 25. Fig. 26. Fig. 27.

DISPLACEMENT OF CENTRE OF GRAVITY OF MAN WHEN WALKING.

as the case may be. We can readily see how this gives the required impetus, if we consider the manner in which the shove-off is done by an expert swimmer in a bath, when he comes to the end of it, and wishes to touch, turn, and strike off without loss of time. He, as we all know, will, as much as possible, draw up the leg with which he is going to give the shove off, and having applied it to the side of the bath (Fig. 28), will suddenly straighten it out, with the result that his body will be shot forward (Fig. 29). Here the drawn-up leg, which acts as a spring, is placed between two objects: one (the body) movable, the other (the side of the bath) immovable. When the leg is extended, the movable object is naturally the one to be displaced. Identically the same action occurs in the various progressive movements of the horse. We may see it, also, in the run of the pedestrian, which is depicted in Figs. 30, 31 and 32; for the right leg, which is a good deal bent in Fig. 30, is nearly straight in Fig. 31. The straightening of the limb or limbs, in effecting the forward propulsion of the body, is even better shown in Figs. 33, 34, 35 and 36, which depict the standing leap.

Fig. 28. Fig. 29

SHOVE-OFF FROM SIDE OF SWIMMING BATH.



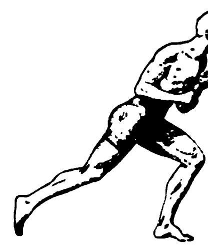
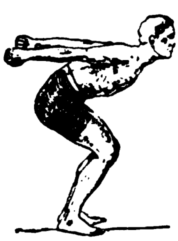
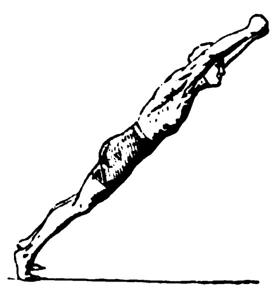
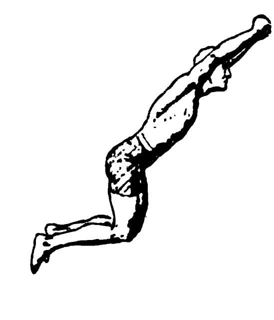


Fig. 30. Fig. 31. Fig. 32.

FORWARD PROPULSION OF MAN WHEN RUNNING.







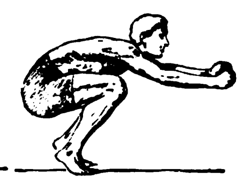


Fig. 33. Fig. 34. Fig. 35. Fig. 36.

FORWARD PROPULSION OF MAN IN STANDING LEAP.

A horse's fore limb is raised from the ground and brought to the front in the following manner: The shoulder-blade (*scapula*, Fig. 18) is rotated, chiefly by its upper end being pulled downwards by the posterior portion of the *serratus magnus* (p. 42), and by its lower end being drawn upwards by the *levator humeri* (p. 43), which also draws the entire limb to the front; the flexor muscles of the fore-arm bend the knee, and the joints of the fetlock and pastern, so as to enable the foot to clear the ground; and the *flexor brachii* (p. 43) assists in straightening the shoulder joint, and raises the knee; and the extensor muscles of the fore-arm finally straighten the knee and all the joints below it. When full extension of the fore limb takes place, all the bones of the leg (from the shoulder-blade to the pedal-bone) are straightened as far as possible. It is evident that

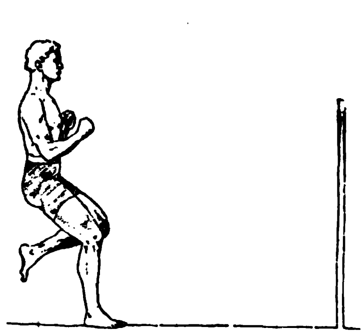


Fig. 37.

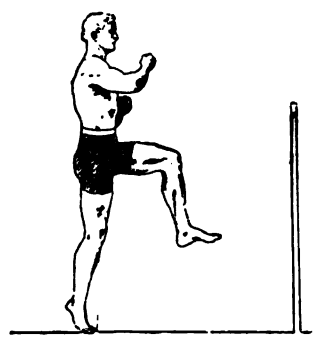


Fig. 38.

Fig. 39.

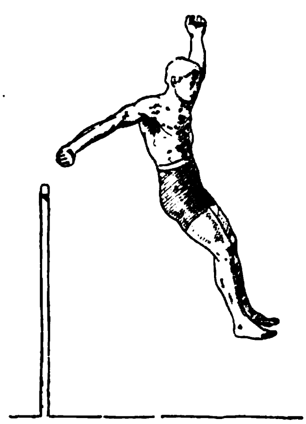


Fig. 40.

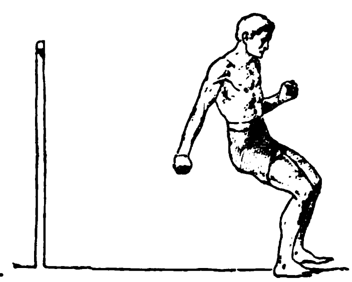


Fig. 41.

RUNNING HIGH LEAP OF MAN.

the less upright (more sloping) the shoulder-blade is, the more can the foot and knee be advanced, and raised.

Propulsion by the hind limb of the horse takes place through the hip joint and pelvis. The impetus from the fore leg at the various paces may be regarded as through the elbow joint and humerus.

Direction of Propulsion, and Distance through which the Centre of Gravity of the Body is Moved.—The direction of the propulsion given by a limb is necessarily through its column of bones. If we examine the illustrations of the progressive movements of the horse, in Chapters XII. and XIII., we shall see that in every case, just before a limb leaves the ground, it is directed backward and downward, as, for instance, the off hind in Fig. 80, and the off fore in Fig. 188. Hence the direction of propulsion in these cases must be forward and upward. The speed at which the body is moving will greatly influence the direction of the propulsion. Thus in Fig. 38, which is one of the series (Fig. 37 to Fig. 41) that shows the running high leap of a man, the impetus from the right leg is given vertically; yet the centre of gravity is projected forward at an angle of about 45° to the ground. The reason for this is, that in this case there are two forces of projection, namely, that derived from the extension of the right leg, and that due to the speed at which the pedestrian ran up to the

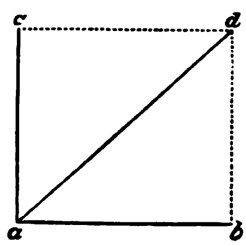


Fig. 42.—Angle of Projection of Centre of Gravity.

jump before he "took off." We have here the operation of "the parallelogram of forces." Thus, if the line *a b* in Fig. 42 represents the horizontal force (derived from the speed) and *a c* the vertical one (obtained from the right leg), and if we draw *c d* parallel to *a b*, and *b d* parallel to *a c*, we shall have the resultant force represented by the line *a d*, and the angle of projection equal to the angle *d a b*.

The upward motion given by the limb to the body is necessary to keep up the centre of gravity, which, if we wish the labour to be accomplished with a minimum amount of muscular effort, should be maintained as nearly as possible at one uniform height from the ground; for the distance through which the centre of gravity is moved, will be a measure of the work done. Let us suppose at each step of a yard long by a horse, that the centre of gravity falls 4 inches, and that the animal has to go a distance of 1,000 yards on a horizontal plane. It is evident that, in this case, the muscles of the horse's limbs would not only have to carry the weight of the body 1,000 yards, but would also have to raise it $333\frac{1}{3}$ feet ($1000 \times \frac{1}{3}$), which would be approximately equivalent to going over a hill that was $333\frac{1}{3}$ feet high and had a base 1,000 yards broad.

It is evident that the less the fall and rise at each step, the lower this supposititious hill would be, and consequently, the easier it would be to walk over.

Although the duty of forward propulsion is chiefly performed by the hind limbs; the greater part of the work of adjusting the position of the centre of gravity during ordinary locomotion, falls on the fore legs. When a horse, for instance, performs the high-school feat of cantering to the rear, the respective rôles would obviously be reversed. The question of the adjustment of the centre of gravity of the body, so that the muscles of locomotion may act to the best possible advantage, will be considered further on.

Comparative Speed in the Action of the Limbs.—The speed with which the body is projected forward, is directly proportionate to the speed with which the limb or limbs are straightened out, and has nothing to do with the strength of the muscles that move the parts. Hence, any excess of muscular development beyond that required for the due working of the limbs, will tend to diminish the speed by unnecessarily adding to the weight to be carried. For this reason, we never see great race-horses of the weight-carrying hunter build. Some of the best (St. Simon and Tim Whiffler, for instance) have been slight horses. In fact, the son of Galopin and St. Angela (Figs. 16 and 17) had singularly light hind-quarters. Even Ormonde, who was very muscular for a race-horse, was anything but broad when viewed from behind (Fig. 384).

The question of the speed of muscular contraction is an abstruse one which still remains unsettled. We know that if a muscle be stimulated by a shock of electricity, it will contract throughout its entire length at (practically) the same moment. Hence, under this condition, a long muscle would contract very nearly in the same time as a short one. When, however, a muscle is stimulated by nerves which act in obedience to the will, the contraction of its various parts does not take place simultaneously, though at such a brief interval that we may regard the delay as inappreciable. Hence, in two limbs which resemble each other in every particular, except that one is short and the other long, the respective extension of both will be accomplished in very nearly the same time, and consequently the speed of the propulsion derived from the long leg will exceed that from the short one, in nearly the proportion which their lengths bear to each other. This conclusion is in accordance with the statement that muscles of speed are long muscles. Besides, physiology teaches us that the thicker muscles are, the slower, other things being equal, do they contract on becoming stimulated. We should content ourselves with taking a broad view of this subject; for conditions vary so much in individual cases, that it is not safe to dogmatise on it.

We have seen that the greater the ability to straighten the leg, the higher will be the speed of propulsion; and *vice versâ*. Hence, if a horse is, for instance, unable from peculiarity of conformation to straighten his hocks (a condition called "sickle-hocks," p. 314), he will not be so fast as he would have been, had he greater freedom in these joints. We may test the truth of this principle in our own selves; for if, when swimming in a bath (p. 61), we wanted to touch and turn, but were unable to straighten our knee on account of an injury or from some other cause, we would be capable of giving only a comparatively poor shove-off. The great beauty of a "straight-dropped hind leg" in the horse, as a conformation favourable to speed, will again be alluded to on p. 314.

The action of the fore limb in raising the fore-hand, which is essential for the regulation of the position of the centre of gravity in locomotion, is also dependent on its difference of length when bent and when straightened out. It is manifest that this difference is due to the action of the shoulder joint, elbow joint, fetlock, and pastern joints. Hence, oblique shoulders and sloping pasterns are "points" of speed and of leaping power. If the shoulder-blade and pastern be upright, the limb will be capable of but slight extension. Here, the knee does not come into play, because it is kept straight, when the fore foot is put on the ground.

In heavy draught, full straightening out of the limbs is not desirable; for the last part of this action is accomplished at a great mechanical disadvantage, to which I have alluded on page 59. At present it is sufficient to compare the action of the limbs to that of the oars of a boat, in which the practically useful work is finished after the oars have passed the line at right angles to the length of the boat; the remainder of the propulsive effect being obtained by a wasteful expenditure of force. Consequently, an increase of speed is procured by an amount of work which is greatly out of proportion to the result. Thus, to double the speed during a certain period of time, it may be necessary for the horse to do five or six times the amount of muscular exertion. For instance, it may be more fatiguing for a horse to go twenty miles in one hour, than fifty miles in five hours. The cart-horse, when in heavy draught, moves his load with his hind limbs in a more or less bent condition (Fig. 126), which gives his hind-quarters the crouching appearance which must be familiar to us all. Sloping pasterns from a load-pulling point of view are objectionable in the cart-horse; for the more oblique they are, the greater is the mechanical disadvantages at which they work (p. 73).

Action of the Muscles which Extend the Vertebræ.—When a horse prepares to kick, he, as a general rule, lowers his head and arches his loins ("puts his back up"), by doing which he relieves his hind-quarters of weight and puts it on his fore-hand. When, on the contrary, he prepares to rear, he raises his head and neck and more or less hollows his loins, so as to lighten his fore-hand and put more weight on his hind-quarters. If we examine Figs. 147 and 148 of the canter, Figs. 172 to 175 of the gallop, and Figs. 224 to 228 of the leap, we shall see that the muscles which enable a horse to rear, greatly aid the forward reach of the fore legs in these movements. Also, the heavier the fore-hand, the greater difficulty will they have to raise it. In the leap, they assist the leading fore leg in raising the fore-hand. If the horse carries a rider, these muscles will have an increased amount of work to do on account of extra weight being put in front, and will tire at a proportionately rapid rate. On examining the illustrations of horses in Chapter XII. at the various paces, we shall see that the faster the movement, the more will these muscles be taxed, on account of the greater distance of the centre of gravity from the hind feet, during the period one or both of the hind limbs support and propel forward the weight of the body. Hence we find that to gallop fast or to jump "big," a horse must have good "rearing muscles" which consist principally of those that straighten the hock, draw back the thigh, and extend the vertebræ of the loins. These muscles also help to "lighten" the fore-hand in the flying trot and fast "pacing," in both of which there is a period of suspension, which will vary in length according to the weight that is on the fore-hand. From these considerations, we may lay down the law that the faster the speed required, the stronger should the "rearing muscles" be. The pair of them (one on each side) that is most readily noticed, is the loin muscles, which in the ox constitute the upper cut of a sirloin, and which, in the horse, we may see just behind the cantle of the saddle. It is evident that the heavier the shoulder, the sooner will these muscles become tired; the shorter will be the stride; and the slower will be the speed. Consequently, horses for fast work ought to have light shoulders. Carrying out the same train of reasoning, we may see that the longer a horse's body, the greater will be the mechanical disadvantage at which these muscles will work; hence, a short body is a desirable point in the race-horse and jumper.

The combined working of oblique shoulders, well-sloped pasterns and strong rearing muscles, by preventing the fore-hand going down at each stride, aids in obtaining the much admired "level" action in the race-horse. An animal which has a long body, heavy shoulders, upright pasterns and weak loins (showing deficiency in the points just advocated), will, if he be put to a gallop, go in an up-and-down style; because his rearing muscles will be over-taxed by the weight of the fore-hand at the end of the long lever made by his body, and because his fetlock joints will have deficient "play."

Although the loin muscles appear to be almost quiescent during easy walking and gentle trotting, they may be observed to act energetically in flexing and extending the loins when the animal is leaping and galloping, and when his powers are taxed in drawing a heavy load. Any one who has ridden races or gallops on speedy thorough-breds, will know from experience the immense power behind the saddle possessed by animals of this class; for the rider cannot fail to feel the vigorous "lift" given by the loins at each stride.

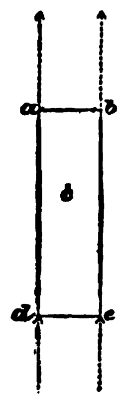


Fig. 43.—Lateral Displacement of Body.

It is a popular fallacy to imagine that the muscles over the loins are propellers. They have no propelling power at all; for they are not connected either with the thigh bone, or with any of the bones of the limb below it; their office in locomotion being merely to regulate the weight on the fore-hand. The muscles under the loins (those which constitute the under-cut in a saddle of mutton, or in a sirloin of beef), draw the thigh forward.

Width between each respective Pair of Legs as affecting Speed.—Let us suppose that the rectangle *a d e b* (Fig. 43) diagrammatically represents the body of the horse; that the fore limbs are placed at the angles *a* and *b*; that the hind limbs are at *d* and *e*; and that the centre of gravity is at *c*. Were both fore legs and both hind legs to act respectively at the same moment, we would have the centre of gravity moved in a straight line, and in the direction in which the animal's body was placed. In the amble (p. 104), the propulsion is given through *a* and *d*, and through *b* and *e* alternately, with the result, in the former case, that the centre of gravity is displaced to the right; and in the latter, to the left. In the trot (p. 101), the alternate strokes are through *a* and *e*, and *b* and *d*. If these respective propulsions, in the trot, were equal to each other, and if the centre of gravity were midway between the fore and hind legs, there would be no displacement of it from side to side. As, however, the impetus derived from the hind limb is greater than that from the fore leg, and as the centre of gravity is nearer the latter than the former, there is a certain tendency to lateral displacement, which has to be corrected by muscular effort. This tendency to a rocking movement from side to side is naturally greater in the amble than it is in the trot. In the gallop there is a strong tendency to lateral displacement; for at this pace, each leg gives its own separate stroke (Figs. 156 to 191). When either of the near ones act, the centre of gravity is canted to the right; when the off ones make their respective effort, it is thrown to the left. The retention of the centre of gravity in a more or less straight line, entails a certain expenditure of muscular work, and consequent fatigue.

It is evident that the nearer (Fig. 43) *a* is to *b*, and *d* to *e*, the less will be the lateral displacement of the centre of gravity, and the smaller the loss of speed from this cause. Hence we find that in animals of great speed, like the cheetah, antelope, greyhound, and race-horse, both the fore and hind legs are respectively placed much closer together than in animals of comparatively greater strength, but of slower movement. The faster the speed (p. 140), the more do the footprints of the horse tend to come into the line of the direction in which movement is taking place. This principle is well exemplified in man; for all fast walkers, runners and skaters try to place the feet, at each step, as nearly as possible, in the same straight line.

As I have already said, the tendency to lateral displacement of weight is corrected to a certain extent, in his various paces, by the horse, who has, however, to do it by a muscular effort which is a lost force, as regards propulsion.

Effect of Instability of Equilibrium on Speed.—The more unstable, in a forward direction, is the equilibrium of a horse's body during each step at any particular pace, the greater will be the speed which can be developed at that pace; because the more unstable the equilibrium, the more easily can the centre of gravity be brought forward. This fact needs no mathematical investigation, for we all know that if a person is bending forward, it is much easier to push him to the front, than if he was leaning back. As the area of the base of support depends to a great extent on the number of feet on the ground, it follows that when there is a reduction in the number of these feet, at each step, the instability of equilibrium, and consequently the speed, will be increased, as a rule. Thus, in the walk of the horse (p. 108) there are never less than two feet on the ground; three as often as two; and sometimes even four. In the canter (p. 116), we have respectively in three steps, a support of one foot, of two (or of three) feet, and of one foot. In the trot and amble, two feet touch the ground during each step. From this we may conclude that the canter is a faster pace, naturally, than the trot or amble. I am aware that this is not the case with many horses which have been specially trained for match-trotting and match-pacing; but that fact does not bear on the subject in question. Of all paces, the gallop is the one in which the equilibrium is most unstable; for during each stride of it, the centre of gravity is carried farther beyond the base of support (Fig. 167) than at any other pace. Besides, at each step in it, there are fewer feet on the ground, at the same time, than at any other pace.

During continued movement, any addition to speed obtained by increased instability of equilibrium, necessitates increased muscular effort in maintaining the centre of gravity of the body at a suitable

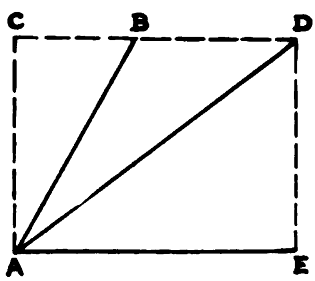


Fig. 44.—Resolution of forces in canter and gallop.

height. In this case, the work falls chiefly on the muscles which straighten the fore legs (extensors of the shoulder and elbow joints, and flexors of the fetlock and pastern joints) of the horse, and varies according to the angles they make, at their respective moments of action, with a vertical line drawn through their points of support on the ground. Owing to the extreme complexity of the animal machine, no exact calculation can be made on this subject; although the following rough statement will help to illustrate the principle under consideration. For the sake of simplicity, only the action of the leading fore leg, which is the chief factor in this question, will be taken into account.

Let B A C (Fig. 44) represent this angle at the canter in Fig. 153; D A C, this angle at the gallop in Fig. 167; and let C B D be a line drawn parallel to the ground (A E). According to the "resolution of forces," the proportion between the work at the canter and the work at the gallop, in these cases, will be equal to the proportion between the respective lengths of the lines A B and A D; the latter being longer than the former. Also, the more the limb is straightened out, the greater is the mechanical disadvantage at which its bony levers act. And, as the extent to which the fore leg can be straightened out, is not sufficient to raise the centre of gravity to the required height at fast paces; extra work is required for the upward projection of the fore-hand, from the muscles which straighten the fore leg. Hence, the faster the pace, the greater will be the muscular expenditure of the fore limbs, as compared to the speed. Consequently, when a horse gallops fast, the muscles of his fore-hand tire much more quickly than those of his hind limbs. Agreeably to this fact, we find that when pedestrians and skaters respectively compete in short distance races, they bend their bodies much more forward, than when going a long journey. Also, when a horse begins to tire in a long distance race, like the Cesarewitch, his ordinary "level" style of "going" generally becomes changed more or less into an up-and-down motion, which is caused by the muscles of his fore-hand being too fatigued to work in unison with those of his hind quarters. A reasonable deduction from the foregoing remarks, is that a saddle-horse, to be a stayer, should be light in front, especially as the presence of his rider causes a disproportionate amount of weight to be placed on his fore legs.

It is evident that the chief advantage which is gained from the "crouching jockey's seat," as regards speed, is due to the fact that the forward position of the rider increases the instability of the equilibrium of the horse. As this seat puts extra work on the muscles of the fore-hand, it is not suitable for a long distance journey, or for jumping.

The fact of a horse "pulling," naturally brings the weight forward, by means of the reins, and thus increases the instability of equilibrium.

In the case of a saddle-horse travelling at a fast pace, the resistance of the rider's body to the wind decreases, to some extent, the instability of his animal's equilibrium. Hence, in this respect, speed is favoured by the crouching position, and is diminished by an erect one. As a somewhat parallel case, we find that a well-marked acceleration of speed on American trotting tracks has been obtained by discarding high sulkies for low ones (Fig. 60), and increasing the shortness of the "hitch." In modern sulkies, the weight is brought forward and the resistance to the air is reduced as much as possible. In heavy draught, the stability of the horse's equilibrium is greatly increased, as a rule, by the resistance which the collar offers to forward movement, and consequently the muscles of his hind limbs usually become much more quickly tired, than those of his fore legs.

As it is imperative that the body of an animal intended for speed should be as light as possible, provided he has sufficient bone and muscle to meet his requirements; the preponderance of weight on the fore hand should be obtained by conformation, and not by any approach to "heaviness" in that part.

Fatigue from the various Paces.—In comparing the fatigue undergone during certain paces, we must be guided by the consideration of the respective distances through which the centre of gravity of the body has to be moved. Let us first of all consider its vertical, and afterwards its horizontal, displacement out of the straight line of the direction in which it has to travel. In the walk and at all other paces in which there is no period of suspension (p. 100), it is carried nearly parallel to the ground, with only a slight fall when each fore leg is taken up. At paces in which there is a period of suspension, the centre of gravity will have to be raised just as much as it will fall during that time. This fact is best marked in jumping; for in making even a long leap, the centre of gravity will have to be raised a considerable height. Thus, when Howard, of Bradford, the famous jumper and sprinter, leaped over a full-sized billiard-table lengthwise, he was computed to have cleared a height of five feet four inches. Hence, animals like the antelope and cheetah, which adopt, when going at full speed, a leaping style of gallop (p. 142), can keep it up only for a short time. This fact is particularly well marked in the case of the kangaroo. For the same reason, a horse can go a distance with more ease to himself at a slow trot (which has no period of suspension), than at the flying trot (p. 102) or gallop (p. 120), in both of which there is a period of suspension. Not only does the consideration of the comparative rise and fall of the centre of gravity give us an idea of the relative fatigue undergone during the various paces; but it also furnishes us with a guide to judge the comparative ease with which different horses move at the same pace. Consequently, we may conclude that the more "level" a horse goes, whether at the fast trot, gallop, or other pace, the less will he fatigue himself: a fact which proves how thoroughly reasonable is the admiration every good judge has for a "level" style of movement—that is, one in which there is the least possible rise and fall of the fore-hand at each stride. I have purposely used the word "fore-hand" here. When noting whether the action of a horse is level or not, we are usually guided by the presence or absence of up-and-down motion of the fore-hand; for the special prominence of the head and neck will more or less rivet the attention of our eyes. Besides, the centre of gravity of a horse's body is nearer his fore legs than his hind ones.

As soon as fast antelopes, like the Indian Black Buck and South African Springbok, get tired in their bounding gallop, they "settle down" to one resembling that of the horse (Figs. 172 to 191). When the cheetah—which, as far as I have seen, gallops like the cat (Figs. 212 to 217), in a succession of leaps—becomes tired of that pace, he drops into a walk or trot.

On pages 68 and 69, allusion has been made to the effects of lateral displacement of the centre of gravity in causing fatigue.

Action of the Head and Neck in Locomotion.—During movement, the head and neck act as a balancing pole in changing the position of the centre of gravity from one side to the other, and in raising or depressing it. Certain muscles of the neck draw the fore limb forward and upward; other muscles of the neck straighten out the head and neck, and a third group bend them.

Mechanism of the Fetlock Joint.—As Lecoq explains, "the weight of the body, transmitted by the cannon-bone upon the upper articulating surface of the long pastern bone, is the resistance to be overcome. The fulcrum is the ground at the toe of the foot, and the power acts upon the sesamoid bones, which are at the back of the pastern; the shortening of the flexor muscles being the cause of the straightening

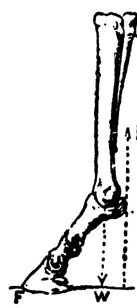


Fig. 45.—Mechanism of Fetlock Joint.

of the angle formed by their tendons." The diagram given in Fig. 45 will show how this lever (one of the second order) acts. In it we see that the distance between the power and weight remains constant; but their respective distances from the fulcrum vary according to the slope of the pastern and hoof, and according to the length from the fetlock to the toe. Hence (pp. 56 to 58), the shorter is the distance of the toe from the direction of the cannon-bone, or from that of the back-tendons, the greater will be the mechanical advantage at which the back-tendons will act; and *vice versâ*. On the other hand, we may see that the more is the mechanical gain, the worse will the fetlock act as a spring, which function is all important in saving the limb (especially the fore one) from the injurious effects of concussion. It is evident that the distance of the weight (or power) from the fulcrum (F) is influenced by the length and slope of the pastern; it being greatest when the pastern is long and oblique, and least when that part is short and upright. Also, increased growth of hoof, either at the toe or heel, will affect the slope in question, and the thickness of horn at the toe will, of course, influence the length from the fetlock to the toe. As a practical point, we should bear in mind that the toe (except in the treatment of some forms of disease) should always be kept low, and that shoes should be no thicker at the toes than what would be sufficient to enable them to stand "wear." Special allusion to this subject has been made in *Veterinary Notes for Horse-Owners.*

Mechanism of the Hock Joint.—Figs. 46, 47, and 48 show the three actions of this joint as a lever.

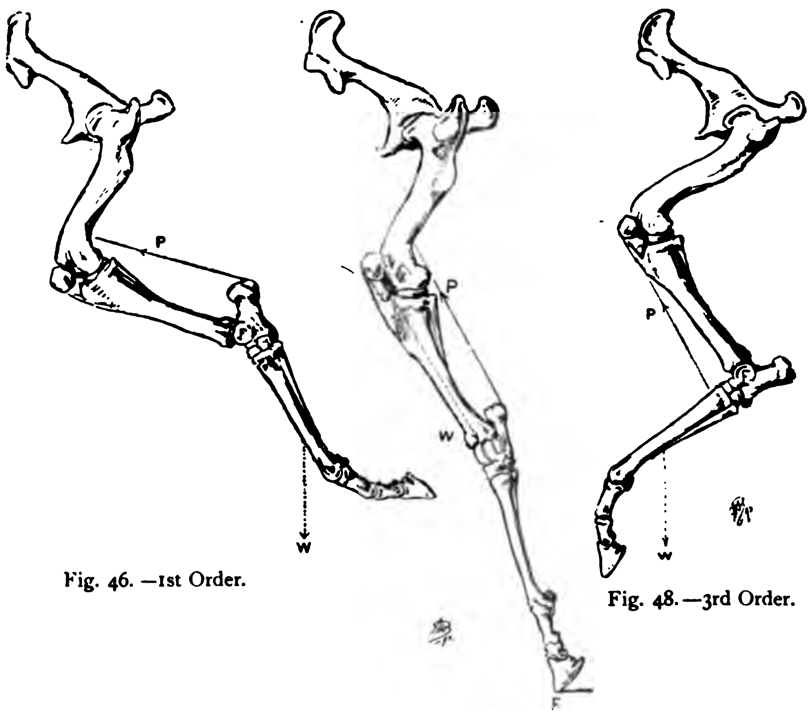


Fig. 46. —1st Order.

Fig. 48.—3rd Order.

Fig. 47.—2nd Order.

LEVERS OF THE HOCK.

Besides flexion and extension, this joint has an outward motion, due to the outward and forward direction of the pulley formed by the astragalus.

We find, contrary to what we might have expected from an inspection of this bone, that this oblique play of the hock joint does not affect the direction in which the hind foot is carried; its object being, as explained by H. Bouley, to allow the stifle to clear the abdomen, when the hind foot is brought forward.

CHAPTER IX.

MECHANISM OF DRAUGHT.

DRAUGHT in the collar or breast-harness is, as explained by Colin, an act of pushing, and not of pulling. The only kind of draught I have ever heard of, which could be put under the latter heading, is that of making a horse draw by attaching the weight to his tail, like what farmers in some countries used to do long ago, when they wanted to plough!

Propulsion in draught, like in other forms of locomotion, is effected by placing a series of levers, bent on one another, between a fixed point and a movable one. In the locomotion of the body, the series of levers are those only of the limbs. The movable point, in the hind limb, is the portion of the pelvis against which the head of the thigh bone rests; and in the fore extremity, the lower end of the humerus. In harness, on the contrary, the series of levers is that between the spot against which the foot rests and the centre of pressure on the inner surface of the collar, which, in this case, is the movable point.

In Fig. 49, the line A B represents the direction of the propelling force given by the hind leg which is on the ground; and E B, that by the fore limb; B being the assumed centre of pressure. The resultant of these two forces must pass somewhere between the points A and E, and through the point B. It is, however, impossible to fix its exact direction; as we cannot determine the respective amounts of these two forces, and as the proportion they bear to each other continually varies. If two hind feet, as in Fig. 127, were engaged in pushing against the collar at the same time, the direction of their resultant would naturally pass between them and between the two points occupied by the respective centres of pressure on each side of the collar. From a practical point of view, we may assume that this centre of pressure, on each side, is on a level with that portion of the harness to which each respective trace is attached. This would place it somewhere between the middle and lower third of the bearing surface of the collar.

The force applied to the collar by the animal, is obtained in two different ways: first, by the weight of the animal, and second, by the force of propulsion to which I have just alluded.

The weight of the animal acts on the collar by reason of the centre of gravity being placed in front of the base of support (p. 60), the anterior limit of which is marked by the position of the toe of the fore foot that is on the ground. It is evident that the farther a perpendicular dropped from the centre of gravity falls in front of the base of support, the more effectively will the weight of the body act in propulsion. This forward translation of the centre of gravity with reference to the position of the base of support, is influenced, first, by the degree of slope which the fore leg makes with the ground immediately before it quits it, and before the other fore leg is brought down; and second, by the lowering of the head and neck. It is manifest that horses with toe-pieces to their fore-shoes can, while retaining their foothold, bring the centre of gravity farther beyond the base of support, by the slope of the fore leg which rests on the ground, than they could do with flat shoes; supposing, of course, that the surface of the ground was not abnormally smooth and hard, like wood or asphalte. From the foregoing considerations, and from arguments which will be submitted further on, we may draw the following deductions with respect to cart-horses that are required to exert their strength to the utmost.

1. Bodily weight, especially in the fore-hand, is an advantage in draught; for the greater it is, the more effective will be the push against the collar caused by the centre of gravity falling beyond the base of support. Agreeably to this fact, the experienced driver of a heavily-laden two-wheeled cart will endeavour to place a fair share of the burden on the animal's back, so that the horse may pull to the best advantage. The experiment of a man winning a single-handed "tug of war," against a stronger man than himself, by carrying another man on his back, is also an instance of this principle. The gain in power from increased weight on the fore-hand is well illustrated by the practice, which I have seen, of the driver of a one-horse cart mounting his animal and getting well forward on its back, when he finds that it is unable to pull its load up a hill.

Bodily weight is of special use in draught on slippery roads, such as those of wood pavement and asphalte; because, in such a case, the security of the foothold of a heavy horse would not be so much endangered as that of a lighter, though equally strong, animal. Also, the employment of bodily weight on a smooth and level road, would entail less strain and fatigue, than that of muscular propulsion. Hence, improvements in roads have been accompanied by increase in the weight of cart-horses. The question as to the relative proportions of the weight and strength of these animals cannot be decided with accuracy owing to the infinite variety of conditions which would have to be considered. We may, however, take for granted that the comparative weight which would be an advantage to a heavy draught-horse in a city like London, would be a decided drawback to the efficiency of a cart-horse that had to do his work on arable land, especially if it was rough, like on " ridge and furrow " ; because the raising of his weight at each step, would entail far greater muscular exertion, than if his labour was on a smooth road. Sanson (*Traité de Zootechnie*) considers that about 1100 lbs. is the best weight for a horse of light draught, and that the heavy cart-horse should not weigh more than 1,760 lbs. (800 kilogr.) and not less than 1,540 lbs. (700 kilogr.).

2. The cart-horse ought to have a heavy neck as well as massive

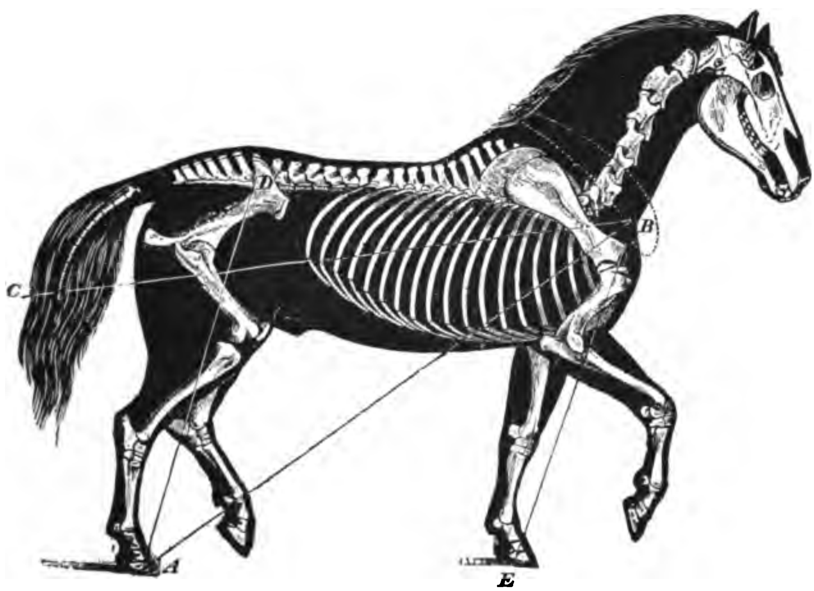


Fig. 49.—Mechanism of Draught. (From Colin's *Physiologie Comparée.*)

shoulders. As a natural corollary to this proposition, which infers the lowering of the head and neck, we must condemn the constant use of bearing reins with the class of horse which we are now considering.

3. The shoes of the horse should have toe-pieces when the ground is favourable to their employment.

4. The fore-hand should be light and the head carried high, when the horse, on account of the slippery nature of the ground, is unable to use his fore legs, except to a very slight degree, as propellers. Thus, the weight has to be kept almost entirely off the shafts of London hansom cab-horses, which would be rendered very liable to fall down on the greasy wood pavement and glass-like asphalte, if a fair proportion of the load were to be put on their backs. Not only is weight kept off their backs,

but as a rule it is so distributed as to cause the back-band to exert on the "girth-place" an upward pressure, which, naturally, will more or less aid in "lightening" the fore-hand.

5. The force of propulsion given by a hind limb is dependent on a series of levers which extend from the toe of the hind foot, along the bones of the hind leg, pelvis, spinal column, up to the centre of pressure on the inner side of the collar. It is manifest that the flatter this irregular line of levers is with reference to the line of propulsion from the toe of the hind foot to the collar, the greater will be the mechanical advantage at which the hind limb will act. Consequently, we may infer that the cart-horse should be long in the body, as compared to his height; that he should be lower over the croup than he is at the withers; and that he should not have a horizontal croup. We should not, however, desire his hind-quarters to be so dropping as to cause him to be actually "goose-rumped" (Fig. 333).

6. It is a well-known mathematical fact that the most advantageous direction for a purely mechanical pull, such as that of a rope which is attached to a traction engine in movement, is one which makes an angle with the ground equal to the *angle of friction*. I may explain that if, for instance, 10° was the greatest slope of ground upon which a body could rest without sliding down, its angle of friction would be equal to 10°. From this law of mechanical traction, one is apt to wrongly infer that the best direction of the traces would be at an angle to the ground equal to the angle of friction. As Major Dwyer (*Seats and Saddles*) justly points out, a more useful effect "may be attained with traces which are so disposed as to enable the horse to exert his entire strength under a theoretically less favourable angle of traction than when the ease of the animal is sacrificed to a correct, but, in such a case, inapplicable mathematical principle. In a word, our contention is, that the angle of traction must be regulated with reference to the horse, and not to the carriage exclusively." Major Griffiths (*The Artillerist's Manual*, published many years ago) remarked that the best disposition of the traces in draught is when they are perpendicular to the collar, which very useful suggestion Major Dwyer greatly improved by saying that they should be perpendicular to the horse's shoulder blade. By accepting this thoroughly sound statement, and by bearing in mind the mechanical law of traction to which I have referred, we arrive at the important conclusion that the greater the angle of friction of the ground, the more sloping should the shoulders of cart-horses be. Hence, for work on arable land, we require a horse with more sloping shoulders than on smooth roads.

CHAPTER X.

ATTITUDES OF THE HORSE.

Standing at Attention—Standing at Ease—Carriage of the Head and Neck.

Standing at Attention.—When a well-shaped and sound horse *stands at attention,* if I may use the term, he has his head and neck raised, ears pricked forward, the profile of the face at an angle of about 60° (Fig. 52) to the ground, and at about a right angle to the upper line of the neck (the crest); and the weight distributed in due proportion on all four limbs. If the hind feet be equally advanced, a perpendicular line dropped from the point of the buttock will, on the respective sides, about touch the point of the hock (Fig. 50). If one hind foot be placed in front of the other hind foot, the vertical line will, more or less, divide the interval between the points of the two hocks (Fig. 52). As the weight of a horse's head and neck is beyond the base of support formed on the ground by his feet; he would stand more or less "over" on his fore legs—that is, their direction would be downward and backward—if they were equally advanced, and if each of his hind legs were fairly "well under him." When one fore leg is advanced more than its fellow, and when it is vertical, the animal will of course be somewhat "over" on the other fore leg.

French writers consider that when a horse stands with the weight properly distributed on all his limbs, a line dropped from each point of his buttock will coincide with the posterior edge of his hind leg, from the point of the hock to the fetlock; and that the direction of the front legs will be vertical, as in Fig. 53. I have never seen a horse adopt this attitude (Fr. *le placer*). Fig. 54 is the nearest approach to it in a well-bred horse that I have been able to get in a photograph, of which this illustration is an exact copy.

Many persons maintain that a well-shaped horse, no matter what his class may be, will, when he stands, have his hind legs "well under him," as in Fig. 50; such a position being regarded by them as a point of conformation, and not as an attitude. We can see the fallacy of this idea if we compare Fig. 50 with Fig. 51, both of which photographs were taken within five minutes of each other. In the former, Bendigo's* hind legs are well under him, but in the latter they are a little behind him. In judging the way a horse stands, we should consider the position of the fore legs, as well as that of the hind ones. Thus, in Fig. 50, the fore legs "stand over"; and in Fig. 51, they are more or less vertical, owing to the fact that the hind feet are farther away from the fore ones than in the former case. Also, the position of the head and neck should be taken into account; for the higher they are raised, the greater tendency will the horse have to bring his hind legs under him, so as to support the increased weight thrown on them. The zebra appears to have a larger proportion of weight "behind," than any other member of the horse family, and consequently his hind legs are very well under him (pp. 310 and 311). The thorough-bred, on the contrary, has a relatively small proportion of weight behind (p. 53), and for that reason we cannot expect him to stand with his hind legs so well under him, as a cart-horse would do.

* Bendigo (by Ben Battle—Hasty Girl) was one of the best race-horses of the last century. As a 3 year-old, he won the Cambridgeshire (£1,672), carrying 6 st. 10 lb.; as a 5 year-old, the Lincolnshire Handicap (£1,724), 8 st. 5 lb., and the Hardwicke Stakes (£2,727), 9 st. 12 lb.; as a 6 year-old, the Eclipse Stakes (£10,000), 9 st. 7 lb.; and as a 7 year-old, the Jubilee Stakes (£2,850), 9 st. 7 lb., and the Champion Stakes (£1,131), 9 st.

Photo by] [ARTHUR MOORE, LEICESTER.

Fig. 50.—Mr. H. T. Barclay's Bendigo.

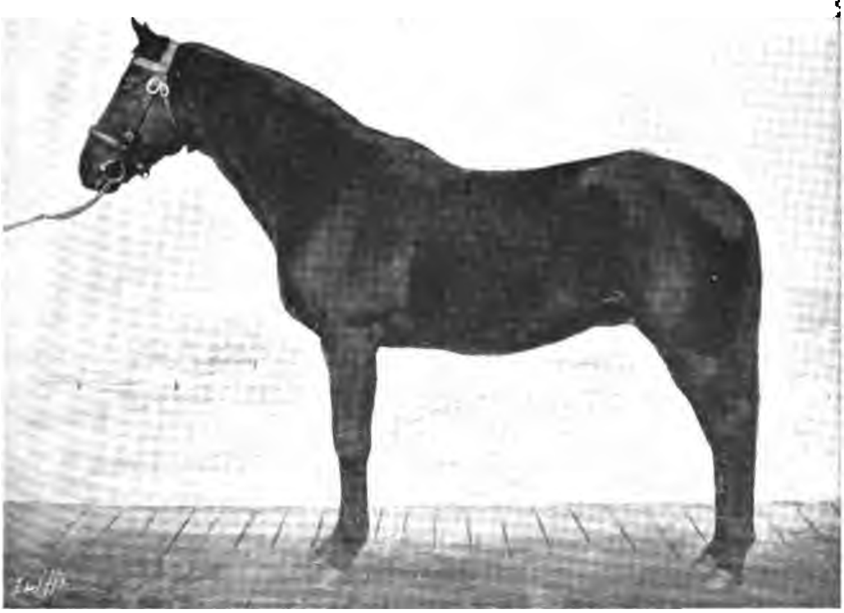


Photo by] [ARTHUR MOORE, LEICESTER.

Fig. 51.—Mr. H. T. Barclay's Bendigo.

In the *front view of a horse* which is standing in an unconstrained position, with his feet equally advanced and a little distance apart, the fore-arms will slightly converge, and the cannon-bones will be about parallel to each other (Fig. 55). A vertical and longitudinal plane passing through the centre of the knee and fetlock of each leg will cut the centre of the toe. In Fig. 56, the toes are turned in, and in Fig. 57 they are turned out. For further remarks on this subject see pages 295 to 297.

The rear view of the horse in Fig. 58 illustrates the condition known as "cow-hocks," in which the points of the hocks are more or less turned in. Figs. 59 and 385 show symmetrically shaped hind legs, viewed from behind. Although I have devoted much careful study to this subject, I can apply no geometrical rules to determine, as some writers have tried to do, the correct shape of the legs from this aspect. I venture to think that it can be judged only by the trained eye of the observer, in deciding whether the hocks are correctly placed, or whether they are turned in, or turned out.

Standing at Ease.—A sound horse will, almost always, when standing at ease, have both fore feet equally advanced, and with his weight chiefly on them; for he can obtain this support in front, without muscular effort on his part (to which fact I shall presently again refer), and consequently without fatigue. His head will be lowered, and will be supported by the suspensory ligament of the neck, the action of which can also be utilised without fatigue (p. 39). As the hind limbs are unprovided with an apparatus by which they can bear weight without fatigue; their muscles have to obey the law which requires, for the health of muscular tissue, alternate periods of rest and work. Hence, one hind limb is usually rested by its joints being bent and its heel raised, while its fellow supports the weight of the hind-quarters.

When the working hind limb becomes tired, the other one takes its turn of work ; and so on.

When a couple of long-tailed horses are in the open at liberty, they will sometimes elect to stand head and tail together, so that each one by the action of its tail can keep flies off its own hind-quarters, and off the head, neck, and shoulders of its fellow.

If, while standing still, horses are exposed to inclement

Photo by] [M. H. H.

Fig. 52.—Standing at Attention.

weather, they will generally try to turn their hind-quarters towards the direction from which the rain or wind proceeds (p. 416).

The fore limbs of a horse are furnished with special fibrous bands (ligaments), which, during rest, take the weight off the muscles that straighten the various joints. These ligaments are composed of hard, inelastic, fibrous tissue, and act simply as strong cords in connecting the parts together. The work they perform being entirely of a passive nature; they do not get tired, like muscles, the work of which is of an active form, and cannot be continued without suitable intervals of rest. As an instance of this "bracing" function of ligaments, we find that the fetlock is passively supported during rest (taken in a standing position) by an inelastic fibrous cord, which goes behind the fetlock joint, and is attached by one end to the head of the cannon-bone, and by the other to the base of the pedal bone. Not only are the fore legs provided with these special ligaments, to prevent the limbs from "doubling up"; but most of the muscles which straighten the legs during work, are composed of a large amount of ligamentous fibres. Such muscles, therefore, during their periods of rest, can assume to some extent the functions of ligaments. In fact, one powerful muscle in the fore leg of the dog is represented in the horse by a ligament (the suspensory). Besides, the muscles which straighten the fore limb are not single, but multiple muscles, one of which can take its turn at work, while its fellows rest.

This mechanism enables the horse to sleep standing without extraneous support, and is clearly and exhaustively described in Colin's *Physiologie Comparée.*

Carriage of the Head and Neck.—The attitude which the head and neck assume is determined by the following considerations: (1) *For the horse to be able to see in the required direction.* If we regard a horse that is standing at attention (Fig. 52), and is looking straight in front of him, we shall see, as a rule, that his neck is held in an easy position, being neither stretched out nor drawn back, and his head is placed so that the line of his face will make an angle of about 60° to the ground. We may, therefore, consider that the axis of each eye is at about that angle to the line of the face. In man, the angle is about 90°, the difference between the two being chiefly one of brain capacity. In the horse, the occipital crest, which is the highest point of the animal's head, may be regarded as a continuation of his forehead. In man, owing to the bulging-out condition of the brain, it is the bony prominence just above the back of the neck.

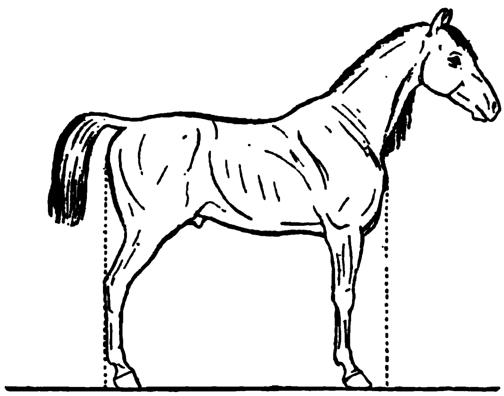


Fig. 53.—Le Placer. (*After Goubaux and Barrier.*)

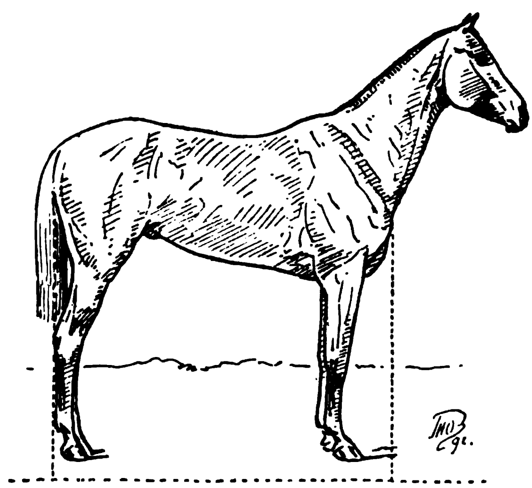


Fig. 54.—Standing at attention.

When a horse wishes to take a good view of the ground in front of him, he will, by the adjustment of his neck, adopt a lofty carriage of the head, while keeping the line of the face at an angle of about 60° to the ground. If he requires to see an object which is on the ground and which is only a few yards in front of his feet, he will bring the line of his face perpendicular, or nearly so, to the ground. Of course, the axes of the eyes can be altered to a greater or less extent, without the head being moved; but the horse possesses such great mobility of head and neck that, when he is free, he will adjust his line of vision principally by the movement of these parts.

It is therefore evident that if we want a horse, when riding or driving him, to have a good look at the ground over which he is about to go, we should allow him, or endeavour to induce him, to carry his head at an angle of about 60° to it. A more perpendicular carriage of the head would be permissible only for riding-school work, or for evolutions in which freedom of movement has, to some extent, to be sacrificed for obtaining thorough power of control. If the angle which the face makes with the ground be much less than 60°, the animal will not be able to see where he is going, as accurately as if his head was in its normal position.

(2) *To permit of free movement of the fore limbs.*—My readers will remember that the shoulder-blade of the horse, on each side, is connected to the body by muscles which allow it to work backward and forward on the chest. As the shoulder-blade and humerus (Fig. 18) are drawn forward and upward by muscles of the neck; it follows that the direction of this pull will be regulated, to a great extent, by the direction in which the horse carries his head. Hence, if we require "lofty" shoulder action, we must get him to carry his head comparatively high. If he carries it low, only a slight upward lift can be given to the shoulders. In such a case, to make up for want of shoulder action, the horse will probably increase his knee action, which is obtained by muscles that have no power to move the shoulders. Thus, we may see a horse which has free shoulder action and gallops with a straight knee, when he carries his head fairly high, go in a "round" and cramped style, if he be permitted or induced to

Fig. 55.—Well-shaped fore legs.

Fig. 56.—Turned-in toes.

Fig. 57.—Turned-out toes.

Fig. 58.—Turned-in hocks.

Fig. 59.—Well-shaped hind legs.

carry his head low down. We may see by reference to the figures in Chapter XII., that in all paces, and especially in fast ones, in order to obtain good forward reach, it is requisite that the fore limb should be drawn upwards as well as forwards. The defect, as regards want of safety, in the fore feet not being lifted sufficiently off the ground by the play of the shoulder, may be compensated for by increased knee action, which, however, will have no effect in lengthening the stride; but will, in causing loss of time in putting down the fore feet, tend to diminish the speed. The use of the curb bit has so often been found to injuriously affect the action of race-horses by, as a rule, making them carry their heads low down, and consequently to gallop "round," that it is very seldom used with these animals. Trainers of match-trotters and match-pacers employ an "over-draw check-rein" (bearing-rein, Fig. 60) to improve the action of horses which do not carry their heads high enough, and which, on that account, have too low action. The bearing-rein is, in many cases, necessary for the attainment of that "extravagant" action which is greatly sought for among fashionable carriage horses: a fact which accounts for its retention in the stables of the rich, despite the adverse criticism that is being constantly directed against its use. As a rough guide to the direction of the neck (supposing it to be straight or only slightly bent), when the line of the face is at an angle of about 60° to the ground, I may say that, at ordinary paces, the upper part of the nostril should not be lower, or only slightly so, than the top of the withers. In the fast gallop, the horse will carry his head lower down than this, so as to bring his weight forward, and thus to increase his speed (p. 69). This difference in the carriage of the head will be evident, if we compare Figs. 138 to 146 with Figs. 156 to 171. A fairly high carriage of the head, with the face at the angle just mentioned, is a most desirable point in the cross-country horse, which requires to obtain a good view of the ground and obstacles in front of him, and to have free shoulder action; in other words, to be "light in front," which implies that his hind legs are "well under him." If, on the contrary, we want a horse to rein-back (p. 129), we should make him lower his head and bring it perpendicular, or nearly so, to the ground, in order to put weight on his fore legs and lighten his hind ones. Those

Fig. 60.—Star Pointer in Faber Sulky.

of my readers who have studied high-school riding, will remember that, according to the teaching of Baucher, who introduced many valuable improvements in military equitation, the normal position of the head of the school horse was perpendicular to the ground; and that the head was carried comparatively low. That admirable exponent of *la haute école*, James Fillis (*Principes de Dressage*), having wisely rejected, even in the most elaborate *airs de manège*, this artificial style, teaches that the school-horse should carry his head high and the muzzle well advanced out of the perpendicular. If the head be carried too high; forward reach will be proportionately sacrificed to upward shoulder action, with consequent loss of speed. Hence, hunters, animals that require to be clever over bad ground, such as pig-stickers and Colonial stock horses, and those in which showy action is sought, such as chargers, school-horses, and park-hacks, should carry their heads higher than animals in which speed is the chief consideration. The more the fore legs are lifted by the play of the shoulders, and not by the mere raising of the knees; the safer, more brilliant, less fatiguing, and faster will the action be in every class of horse.

The chief muscle which draws the fore limb (of each side) forward and upward, is attached by one end to the humerus and by the other to the top of the head. Other muscles that draw the shoulder-blade forward and upward, are attached to it and to the ligament of the neck, which stretches from the withers to the top of the head (p. 39). As muscles act best when their points of attachment are wide apart; the horse, during rapid movement, regulates, under normal conditions, the amount of the extension of his neck, according to the speed at which he is going. In this case, the head and neck are the fixed point; the fore limb, the movable one. As long, therefore, as the speed of any particular pace remains uniform, the length of the neck (measured roughly from withers to top of head) should continue unchanged. Consequently, when riding or driving, if we desire the horse to maintain a uniform rate of speed, we should keep a uniform tension on the reins (note, for instance, the fixed position of the hands of a capable lad from a racing stable, when he is riding a steady training-gallop), and should not "give and take" with them. If the speed be increased, the hands, supposing their hold on the reins remains unaltered, should be advanced, as may be required; if it be decreased, they should be drawn back. Thus, any alteration by the rider, of tension on the reins which might impede the legitimate movements of the neck, is avoided. As the joint which the head makes with the *atlas* (first vertebra of the neck) is situated some distance below the top of the head, it follows that if the muzzle be unduly stretched out, the occipital crest (top of the head) will be brought back, and the tension of the ligament of the neck lessened, with consequent decrease of power in the muscles which are attached to this ligament. The muscle which is attached to the humerus and top of the head, also would work to disadvantage, if the muzzle were stretched out to a greater extent than would bring the line of the face at a right angle with the direction of this muscle, which forms the upper border of the jugular groove.

(3) *To regulate the position of the Centre of Gravity.*—The more the head is advanced to the front, the more unstable will be the equilibrium, and the greater will be the speed during progression (p. 69). Hence, the race-horse, when galloping at full speed, will bring his head forward as much as the other conditions which affect its carriage will allow him to do. The cart-horse, if he has good foot-hold and no bearing-rein, will also, when pulling a heavy load, lower his head and stretch it out, so as to bring the centre of gravity forward as much as possible. Here I assume that the ground is soft enough to allow him to "dig his toes" into it, or, if it be rough, that he is provided with toe-pieces on his front shoes. If, on the contrary, the roadway is slippery, like the London streets which are covered with asphalte or wood, the cart-horse in heavy draught, being afraid of falling down if he throws his weight into the collar, will try to keep the centre of gravity back by holding his head high, while trusting almost entirely to his hind legs to push the body forward. When a horse rears, halts suddenly, or reins-back in heavy draught (p. 130), he will raise his head and neck, so as to bring the centre of gravity back. Any one who has

ridden much "over a country," will know the great use a horse makes of his head and neck for regulating the position of the centre of gravity when jumping, and especially when he makes a "mistake."

(4) *To enable the Mouth-piece of the Snaffle to act efficiently on the "bars" of the Mouth.*—The "bars" of the mouth are those parts of the gums of the lower jaw which are bare of teeth, and which are situated between the back-teeth and the tushes of the horse or gelding, or the spots which they would occupy, were these canine teeth developed in the mare. As the "bars" are much more sensitive to pressure than the corners of the mouth; we should, when using the snaffle, endeavour to make the horse carry his head so that he will not shift the mouth-piece off the former and on to the latter. The mouth-piece will, naturally, act best when the head is carried perpendicularly to the ground; but it can also act efficiently if the line of the face is not at a less angle to the ground than about 45°. The apparent anomaly of the mouth-piece of the snaffle not slipping off the "bars" and on to the corners of the mouth in this case, may be explained by the fact that the well-broken horse, when being ridden or driven, keeps the joints of his lower jaw in a more or less relaxed condition, so that the "bars," as a rule, will make a greater angle with the ground than the line of the face will do. When a horse which is ridden in a snaffle, is made to carry his head in a more or less perpendicular manner, he may, as a "defence," relax his jaw, with the object of letting the mouth-piece slip down in his mouth as much as possible, in order that a certain amount of the pull of the reins may be transferred from it to his poll, over which the crown-piece of the bridle passes. Any "defence" which a horse makes by opening his mouth, may be counteracted by the use of a properly applied nose-band.

CHAPTER XI.

STATIONARY MOVEMENTS OF THE HORSE.

Lying Down and Getting Up—Rearing—Kicking.

Lying Down and Getting Up.—When a horse prepares to lie down, he will bring all his feet well under his body, while resting his weight chiefly on his hind legs. After making a few tentative movements with his fore limbs, he will gently lower his fore-hand until his knees lightly touch the ground. He will then give his body a twist, and will roll over, and rest, partly on his side and partly on his breast-bone. Colin describes as follows the position of the horse when lying down. As a rule, if he is on his right side, for instance, the right fore leg will be under the chest, with its foot facing the inside of the left elbow. The other fore, equally bent, but clear of the body, will have its foot close to its own elbow, and there will be a space of about twelve inches between the two knees. The hind limbs will be bent up under the body, with the feet carried to the front. The near hind will be far removed from the side; its hock will be on a line with the hip joint; and its hoof, with the point of the hock. The neck will be raised, and the head will be inclined to the left side. Sometimes the animal rests his lower jaw on the ground. He may even, at certain moments, support his head on the flank or hock, which is a favourite position with cattle, buffalo and deer, when they have stopped ruminating, and appear to want to go to sleep. They cannot, however, long maintain this position.

As the suspensory ligament of the neck can support the weight of the head and neck without giving rise to the sensation of fatigue; a horse can sleep comfortably on his side and breast-bone, and with his head turned to the opposite side. When a horse is very tired, or even when he feels secure from disturbance, he may sleep entirely on his side, with his cheek resting on the ground. On rare

Photo by] [M. H. H.
Fig. 61.—Foal getting up off ground.

occasions, a horse will repose lying down on his breast-bone, with his knees advanced and his heels more or less close to the points of his elbows. This position in shod horses is apt to give rise to "capped elbow," on account of the heels of the shoe of the doubled-up fore leg pressing on the point of the elbow. It is not an easy position for a horse; because the sharp keel of his breast-bone will be liable to be hurt by contact with the ground. It is, however, the natural sleeping position of horned cattle, which can rest at ease in this manner, because the keel of their breast-bone is broad and flat.

In getting up, the horse straightens his fore-legs out to the front (Fig. 61), and with a strong effort places his fore feet on the ground and raises his fore-hand, so as to sit up like a dog. With another effort he raises his hind-quarters and stands on all four feet.

Photo by] [J. DELTON, PARIS.

Fig. 62.—Horse Rearing.

Rearing.—When a horse prepares to rear, he will get his hind feet well under him and will raise his head, so as to "lighten" his fore-hand, which he will lift off the ground by the straightening out of one or both fore legs, and by the action of his "rearing muscles" (p. 67). He will then keep his fore legs bent at the knees and his head high (Fig. 62). In guarding against rearing, the rider should, therefore, lean well forward. If he wishes, by inflicting punishment, to stop the horse from rearing, he had best hit the animal on one of the hind legs, so as to prevent him from fixing them on the ground, in order to "get up"; but he should on no account strike him on the shoulders; for doing so would tend to make him raise his fore-hand. We may break a horse of rearing by teaching him to rein-back in a "collected" manner (p. 129, *et seq.*). By doing this, we "lighten" the hind-quarters and accustom him to lift them and move them freely. In rearing, the horse usually keeps one hind foot advanced more than the other, and his hind feet more or less apart, so as to widen the base of support.

Rearing is a particularly insecure and fatiguing attitude for a horse to maintain; as the column of bones formed by the body and the hind legs has to be kept in position, at its joints (angles), by the exercise of muscular force. In a biped, like man, this column of bones can be brought into a nearly vertical position, so that its component parts can rest on each other, with but little muscular exertion to maintain them in that position. Owing to the large amount and continued nature of this muscular effort in rearing, there will be an appreciable backward and forward sway (caused by the alternate contraction and relaxation of the opposing muscles) at the various joints. This, added to the narrowness of the base of support (formed by the hind feet and the respective lines which join their toes and heels), will render the rearing position so insecure that, to support it, the horse will have to keep frequently changing it. The danger of falling backwards which the animal incurs, if he gets too erect, will naturally help to deter him from trying to assume a comparatively vertical position. Hence, he has to keep the joints of his hind limbs more bent than he would have to do, if he was not exposed to this risk of falling backwards.

The hocks are particularly liable to injury from rearing, owing to the great strain thrown on them when the animal assumes an upright position. Curbs, spavins and other enlargements are of frequent occurrence among circus horses which are trained to walk on their hind legs.

Kicking.—The term "kick" is usually restricted to a blow given by one or both hind legs (Fig. 63). A horse

Photo by] [J. DELTON, PARIS.

Fig. 63.—Horse Kicking.

is said to "strike out," when he makes a forward blow with one or both fore legs. We may regard both these movements as kicks.

A horse can kick in three ways : (1) To the rear with one or both hind legs ; (2) to the front with a hind leg ; and (3) to the front with one or both fore legs. Unlike horned cattle, a horse is unable, without moving the body, to kick to one side, except to a slight extent, owing to the presence of a ligament (*pubio-femoral*) which connects the thigh bone to the pelvis, and which greatly restricts the side action of the limb. If a horse, therefore, wants to kick a man who is standing a little away from its side, he will have to turn round to do so. For this reason, if a person wishes to stand in safety by the side of a horse's hind-quarters, as for instance when examining its hocks, he should get an assistant to stand on the same side, and to draw the head round to it a little, so that the animal will not be able to turn round to kick, if so inclined. If the horse be a vicious kicker, the advisability of getting the fore leg of the side at which one is standing, held or tied up, will be self-suggestive to any one who has had experience with horses. The forward kick with a hind leg (called a "cow kick") has a good deal of range; in fact a horse can, in this manner, hit a man who is standing at its shoulder.

When striking out in front, the horse will generally do so, only with one foot; for the blow can be delivered with greater speed when the other fore foot is on the ground, than if both were off it. If he strikes out with both fore feet, he will do so with a quick, short effort; or he will make a greater or less attempt at rearing, so as to bring his feet or legs on the top of the offending person or animal with the view of knocking it down. The governing idea, more or less developed, of thus overthrowing his enemy is, evidently, to kneel on him and to bite him. This mode of attack is seldom seen in its complete form, except in the case of entires, which are more prone to bite and strike out with both fore feet than are mares and geldings. Mules usually kick out behind with greater freedom than horses, but are not so much inclined to bite or to strike out in front. Mares, from sexual causes, are more inclined to kick with their hind legs, than are the male members of their species.

Horses sometimes kick with a hind foot in a good-tempered way; not for the purpose of inflicting pain, but merely to push the object of their attention out of the way, as we may occasionally see a mare do to her foal. Horses often kick in play without any vicious design. I am convinced that many apparently vicious kicks which miss their marks, are delivered, not with the desire of sending the blow "home," but to warn the intruder against nearer approach.

When a horse kicks out behind, he will put extra weight on his fore-hand, and, as a rule, will lower his head. When he cow-kicks or strikes out in front, he will raise his head and bring his weight back.

In almost all cases, just before a horse kicks, he will draw back his ears, and more or less show "the white of his eyes." If the suspicious object be behind him, he will bring his head slightly round so as to see it, and will prepare for his attack by bending the fetlock and raising off the ground the heel of the hind leg of that side. A horse cannot kick with the hind leg upon which he is resting his weight; for he has to transfer the weight to its fellow before he brings it into play. My readers will observe that I have used the word "slightly" with reference to the extent the animal turns his head when he gets ready to "lash out"; for if he brings it round a good deal, he will be obliged to put more weight on the hind leg of the side to which he is looking, than on its fellow, and would consequently have a difficulty in using it.

CHAPTER XII.

EQUINE LOCOMOTION.

Definitions—The Trot—The Amble—The Walk—The Canter—The Gallop—The Rein Back—Turning and Circling—Buck-jumping—Shying—Foot-prints of the Horse during various Paces.

THERE is no such thing as absolute uniformity in the paces of the horse.

Definitions.—To simplify explanation, we may, when speaking of the limbs, call the near (left) fore and near hind, the *left pair;* the off (right) fore and off hind, the *right pair;* the off fore and near hind, the *right diagonals;* and the near fore and off hind, the *left diagonals.* The meaning of *both fore* and *both hind* is evident.

We may use the word *support* to signify the fact that the weight of the body is borne by one or more limbs, as, for instance, *left support,* when only the left pair are on the ground; and *right diagonal support,* when the right diagonals alone prevent the horse from falling.

A *stride* is the distance from the foot-print of any one leg to the foot-print of the same leg, when it next comes to the ground; or it is the action of the limbs while that distance is being covered.

A *step* is the forward or backward movement of one foot; or it is the distance one foot is removed from its fore or hind fellow.

The term, *period of suspension,* will serve to designate the time during which the animal is completely off the ground at any particular pace, or when jumping.

Natural paces are those which the horse adopts of his own accord, without any teaching of man ; *artificial paces*, those which he performs only after special training.

Time (as applied to the rhythm of a pace) is the number of separate steps in each stride of that pace. Thus, the amble, in which the right pair and left pair move alter-

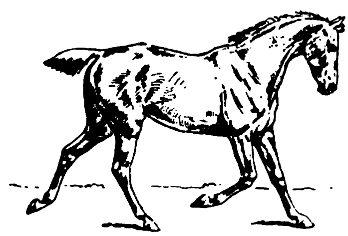


Fig. 64.—Beginning of left diagonal.

Fig. 65.—End of left diagonal.

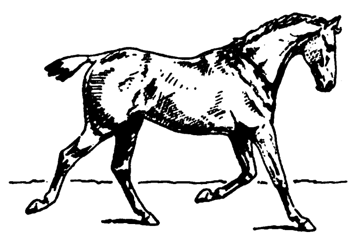


Fig. 66.—Beginning of right diagonal.

Fig. 67.—End of right diagonal.

ORDINARY TROT.

nately, is a pace of two time ; and the walk, in which each limb moves separately, is a pace of four time.

To prevent any chance of confusion, I shall limit, in this chapter, the meaning of the word *pace* to particular and distinct methods of progression, and shall not use it as a synonym for the word *speed*, or for the word *amble*, as Americans do.

The Trot.—We may select the trot to begin with, as it is the simplest of all ordinary paces. Although it is essentially a natural pace, some horses which have been trained to amble, require a good deal of teaching to give up the amble, and to trot in true style. It consists of the alternate action, in progression, of the two diagonals, in each one of which the fore leg and hind leg move in the same manner. Thus, in Figs. 64 and 66, we have the left diagonal support and right diagonal support shown as the diagonal pairs of feet come alternately to the ground. Figs. 65 and 67 depict the position the limbs occupy, just before the feet quit the ground. It is evident that the trot is a pace of two time.

We may divide the trot into three kinds: (1) The *short* or *slow trot*, in which the prints of each respective hind foot do not reach as far forward as those of the fore foot of the same side; and there is no period of suspension. (2) The *ordinary trot* (Figs. 64 to 67), in which the hind feet more or less cover the prints of the fore feet, or even go slightly beyond them, in which case there will be a brief period of suspension. (3) The *flying* or *fast trot*, in which there is a well-marked period of suspension between each stroke of the diagonals (Figs. 68 to 72); the movements represented being those of *alighting*, *support*, *quitting*, *suspension*, and alighting on the opposite diagonals.

The trot is the least fatiguing pace to the horse, by which he can go a long distance continuously at a fair rate of speed; because both fore and hind limbs, respectively, have the same amount of work to do; the body can be more easily maintained in a state of equilibrium by a diagonal support than by a side support, as in the amble; there is but little loss of power in keeping the centre of gravity (p. 53) level; and the pace is a tolerably fast one. It is more suitable for draught, than for saddle, because, in the first place, it is very fatiguing to the rider, especially if he bumps up and down *à la militaire*. Consequently, we find that men who are accustomed to go long distances on horse-back, as in the Colonies, almost always combine the canter and walk instead of adopting the trot. Although rising in the stirrups will make this pace much more easy for the rider, it will not benefit the animal to the extent one might imagine; for, strange to say, almost every horseman, when rising at the trot, invariably comes

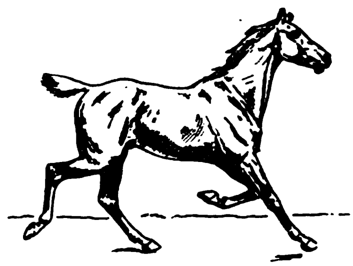


Fig. 68.—Beginning of right diagonal.

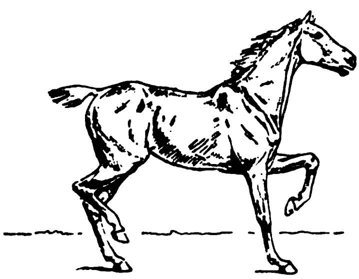


Fig. 69.—Right diagonal.

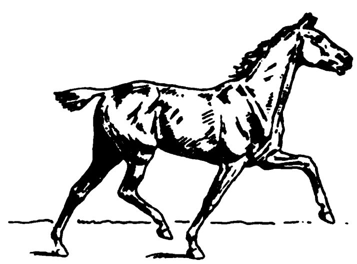


Fig. 70.—Right diagonal.

Fig. 71.—Suspension.

Fig. 72.—Left diagonal.

FLYING TROT.

down on one particular pair of diagonals. Thus, some will put their weight only on the right diagonals; others only on the left. When a rider rises in the stirrups, his weight is borne by only one pair of diagonals. As each pair has to do its own allotted work, it is nearly as well to have both tired, as one fresh and the other fatigued. The chief advantage which rising in the stirrups has to the horse, is that the man who adopts it, conforms better to the movements of the animal than one who bumps up and down. Men who ride, might with advantage learn how to change their time of rising in the trot, so that, after having made one pair of diagonals bear their weight for a time, they might be able to change it on to the other pair. Ladies whose stirrup is on the near side, and who rise in the trot, almost always do so during the left diagonal support, and come down during the right diagonal support. As the weight at the trot is distributed between one hind and one fore leg, the trot (or, possibly, the amble) should be used, when practicable, for going over hard ground, in preference to the canter, and still more so to the gallop.

Figs. 73 to 92 show phases, from photographs, of the trot, from the left to the right diagonal support.

The Amble, which is known in America as "pacing" (Fig. 98), is very seldom a natural gait among horses. Goubaux and Barrier tell us that some foals begin at the amble, and that they do not learn to trot until later, when they have acquired age and strength. Many American match trotters take to ambling, after they have become foot-sore from hard work at trotting. I learn from Professor Ewart that owing to the popularity of ambling in Iceland and consequent selection in breeding, the large majority of Iceland ponies and many half-bred Iceland ponies are amblers from their birth, and that they do not trot.

The amble is a pace of two time, and consists of the alternate movement, in progression, of the right and left (or left and right) pair of legs. In the "flying amble," which is depicted in Figs. 93 to 97, there is a period of suspension between each stroke; but there is little or no period of suspension in the ordinary amble. The amble is a very easy pace for the rider, but is unpopular

Fig. 73.—Beginning of Left Diagonal.

Fig. 74.—Left Diagonal.

Fig. 75.—Left Diagonal.

Fig. 76.—Left Diagonal.

Fig. 77.—Left Diagonal.

Fig. 78.—Left Diagonal.

PHASES OF A MODERATELY FAST TROT.

Photographs by] [OTTOMAR ANSCHÜTZ, BERLIN.

Fig. 79.—Left Diagonal.

Fig. 80 —End of Left Diagonal.

Fig. 81.—Suspension.

Fig. 82.—Beginning of Right Diagonal.

Fig. 83.—Right Diagonal.

Fig. 84.—Right Diagonal.

PHASES OF A MODERATELY FAST TROT (*continued*).

Photographs by] [OTTOMAR ANSCHÜTZ, BERLIN.

Fig. 85.—Right Diagonal.

Fig. 86.—Right Diagonal.

Fig. 87.—Right Diagonal.

Fig. 88.—Right Diagonal.

Fig. 89.—Right Diagonal.

Fig. 90.—End of Right Diagonal.

PHASES OF A MODERATELY FAST TROT (*continued*).

Photographs by] [OTTOMAR ANSCHÜTZ, BERLIN.

(why, I cannot tell) in England. The slow amble (the "tripple") is the favourite pace among the Dutch farmers of South Africa. Baron de Curnieu (*Leçons d'Hygiène Hippique Générale*) tells us that Napoleon I. was accustomed to ride amblers during his campaigns, when he had to go long distances in a short time. If a horse takes readily to the amble, his rider will find it a comfortable method of travelling. The remarks I have made on page 102, *et seq.*, with reference to the merits of trotting, apply equally well to ambling, with the exception that

Fig. 91.—Suspension.

Fig. 92.—Suspension.

PHASES OF A MODERATELY FAST TROT (*continued*).

Photographs by] [OTTOMAR ANSCHÜTZ, BERLIN.

the equilibrium of the animal's body is not maintained as easily in it as in the trot, which, consequently, is the less fatiguing pace to the horse. The amble is the natural pace of the camel.

The amble is a slightly faster pace than the trot; the apparent cause being that in the former, the imprints of the fore and hind foot of each side are, more or less, in a line parallel to or coincident with the line of progression; and consequently there is less lateral deviation than in the latter.

For further remarks on this subject, see page 590.

The Walk.—This is a movement of four time, and is a pace in which all the limbs move, respectively, one after the other. If, for instance, the near fore leads, the sequence is: 1. near fore (Fig. 102), 2. off hind (Fig. 104), 3. off fore (Fig. 106), 4. near hind (Fig. 109). If the near hind begins, it will be: 1. near hind, 2. near fore, 3. off hind, 4. off fore. Each foot comes after the one which precedes it, at an interval of about half the time occupied in taking one step. The result of this is that we

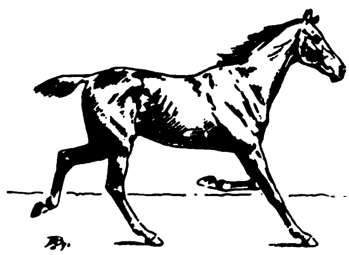


Fig. 93.—Beginning of Right Support.

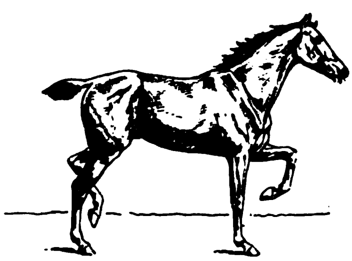


Fig. 94.—Middle of Right Support.

Fig. 95.—End of Right Support.

Fig. 96.—Suspension.

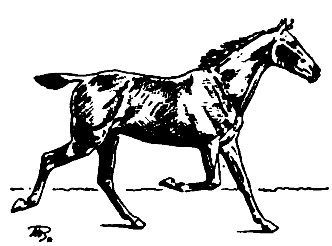


Fig. 97.—Left Support.

FAST OR FLYING AMBLE.

have the following order of supports: 1. right pair (Fig. 101), 2. right diagonals (Fig. 104), 3. left pair (Fig. 106),

4. left diagonals (Fig. 109). As a rule, a horse begins the walk with a fore leg.

We may divide this pace into: (1) *The short stepping walk*, in which the prints of the hind feet do not come as far forward as those of the fore feet of their respective sides. (2) *The ordinary walk*, in which they more or less cover them. (3) *The long striding walk*, in which they go clear in front of them. (4) *The high stepping walk*

Photo by] ["THE HORSEMAN," 368, DEARBORN ST., CHICAGO.

Fig. 98.—Direct Hall, driven by Mr. Geers, and pacing in a Frazier sulky.

which is generally an artificial pace, and in which the feet are raised off the ground higher than usual. (5) *The walk in heavy draught*, which is a short stepping walk, and which has peculiarities that I shall presently consider.

Figs. 110 to 117 give an example of the ordinary walk; for the hind feet cover, as nearly as possible, the prints of the fore feet of their respective sides, and there is no exaggerated knee action.

The long striding walk is shown in Figs. 118 to 123.

Fig. 99.

Fig. 100.

Fig. 101.

Fig. 102.

Fig. 103.

Fig. 104.

PHASES OF THE ORDINARY WALK OF A HIGH CASTE ARAB.

Photographs by] [M. H. H.

Fig. 105.

Fig. 106.

Fig. 107.

Fig. 108.

Fig. 109.

PHASES OF THE ORDINARY WALK OF A HIGH CASTE ARAB (*continuea*).

Photographs by] [M. H. H

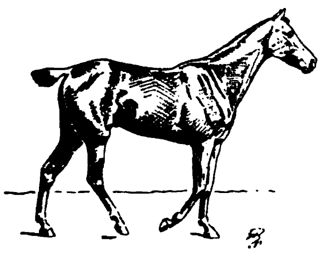


Fig. 110.—Left Support.

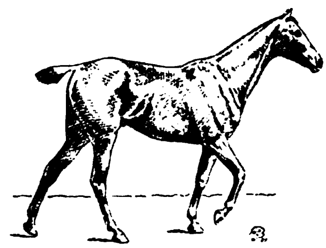


Fig. 111.—End of Left Support.

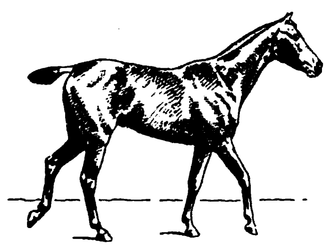


Fig. 112.—Left Diagonal.

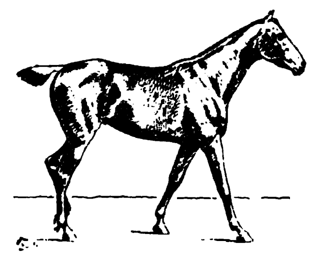


Fig. 113.—End of Left Diagonal.

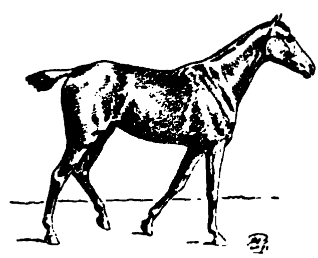


Fig. 114.—Right Support.

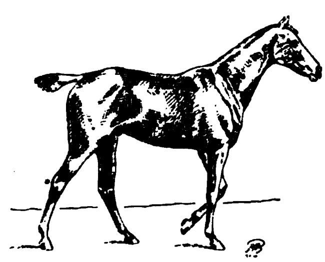


Fig. 115.—Right Support.

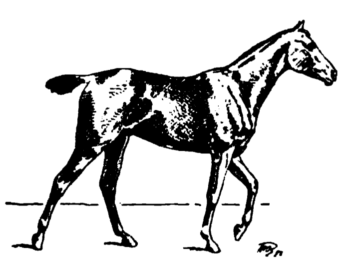


Fig. 116.—End of Right Support.

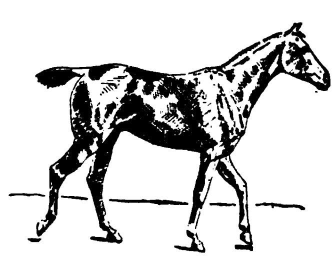


Fig. 117.—Right Diagonal.

ORDINARY WALK.

As an example of the high stepping walk, we may take the action of Napoleon's horse in Meissonier's great picture, "1814" (Fig. 651).

In the various forms of the walk—except in heavy draught on the level or up an ascent, or when going up

Fig. 118.

Fig. 119.

Fig. 120.

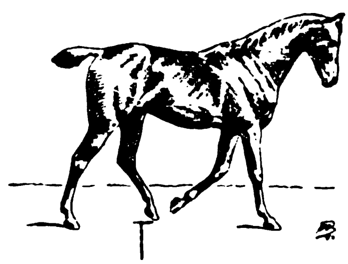


Fig. 121.

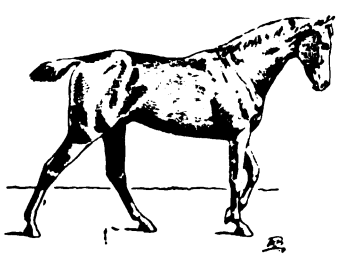


Fig. 122.

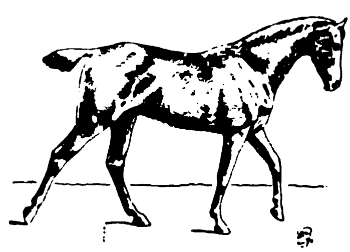


Fig. 123.

LONG STRIDING WALK.

an incline even without having to pull a heavy weight—the healthy horse brings the heel of the foot first on the ground, or the flat of the foot. When the heel precedes the toe in touching the ground, the interval is usually so

Fig. 124.

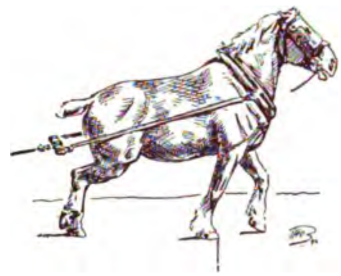


Fig. 125.

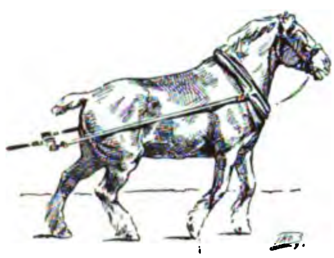


Fig. 126.

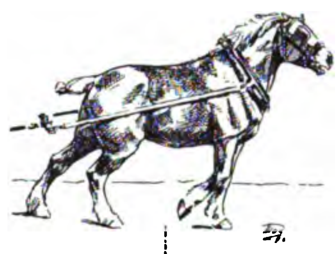


Fig. 127.

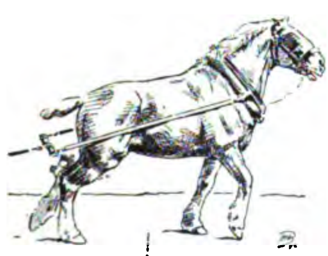


Fig. 128.

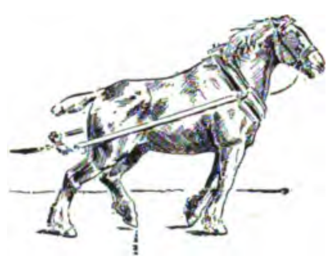


Fig. 129.

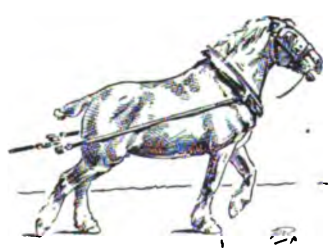


Fig. 130.

SHORT STEPPING WALK IN DRAUGHT.

short that it is all but imperceptible. In horses suffering from certain diseases, especially laminitis (fever of the feet), this interval is so well marked as to be characteristic of the ailment. In heavy draught which taxes the pulling powers of the horse (Figs. 124 to 130), and particularly when going up a steep hill, the toe will be first brought down, as in Fig. 125. In Fig. 124, the right diagonals bear the weight of the horse. In Fig. 125 the near fore comes to their aid. There is a brief left support (Fig. 126). As the off fore is quitting the ground (Fig. 126), the off hind comes down, and continues its assistance while the weight becomes shifted on to the left diagonals (Fig. 128). After that, the weight falls on the right pair of limbs (Fig. 129), and again on the right diagonals (Fig. 130). In heavy draught, we see that during the side supports there are never less than three feet on the ground, and sometimes even four. In the diagonal support, however, the two limbs may be alone on the ground for a brief period, or only very slightly assisted by the other legs. From this we may conclude that, in slow work, a fore and a hind limb work better together when they are diagonals, than when they are on the same side.

In the representations of the walk, as shown in Figs. 124 to 130, and in Figs. 118 to 123, dotted lines are used to mark the position of the toe of one of the fore feet (off fore), so as to compare it with that taken up by the toe of the hind foot of the same side. We accordingly see that in the long striding walk, the hind foot oversteps the print of the fore one, nearly as much as it fails to reach it in the walk during heavy draught.

Figs. 99 to 109 give a series of the normal walk from photographs. The movements of the off (or near) limbs, in Figs. 99 to 103 correspond more or less accurately with those of the near (or off) limbs in, respectively, Figs. 104 to 108.

The Canter.—The canter is, practically, a pace of

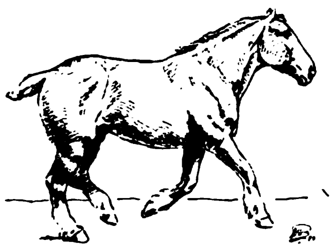
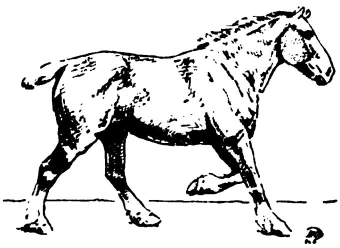



Fig. 131. Support on Off Hind (1st Time). Fig. 132.

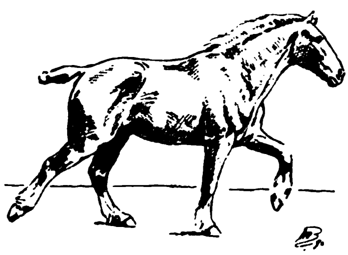
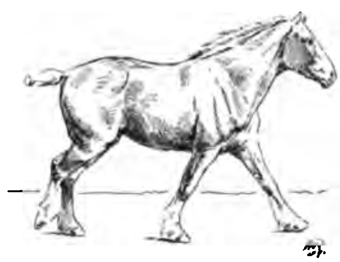



Fig. 133. Right Diagonal (2nd Time). Fig. 134.

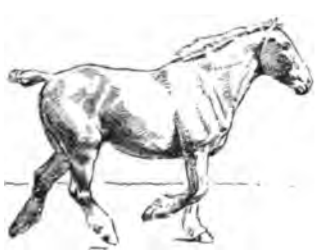



Fig. 135. Support on Near Fore (3rd Time). Fig. 136.

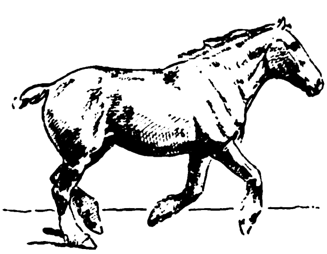


Fig. 137.—Support on Off Hind (1st Time).

CANTER OF CART-HORSE WITHOUT SUSPENSION.

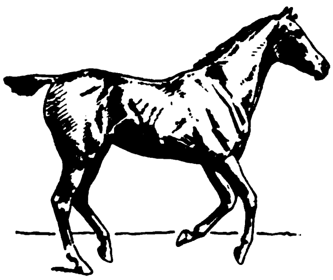


Fig. 138.

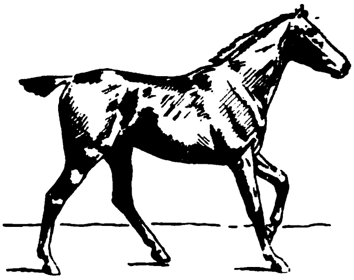


Fig. 139.

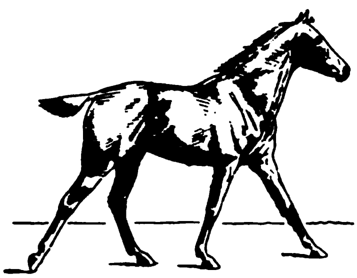


Fig. 140.

Fig. 141.

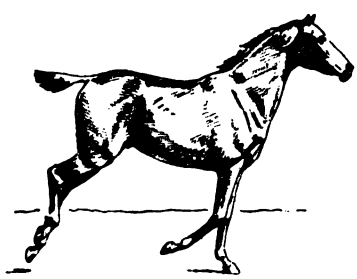


Fig. 142.

Fig. 143.

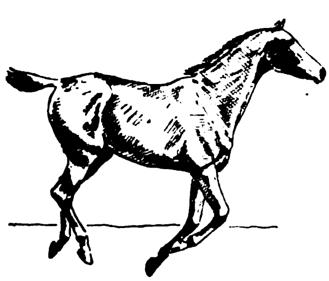


Fig. 144.

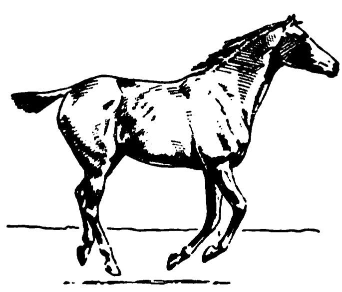


Fig. 145.

CANTER WITH SUSPENSION (HAND GALLOP).

three time, in which the footfalls are, for instance: (1) off hind (Figs. 131 and 138); (2) off fore and near hind (Fig. 133), or off fore followed after a very short interval by the near hind (Fig. 139); and (3) near fore (Figs. 134 and 140), which may or may not be followed by a period of suspension before the horse again brings down his off hind (Figs. 136 and 146). The fore leg of the diagonal support may come down a little before its hind fellow, as in Fig. 139. In the canter of the cart-horse shown in Figs. 131 to 137, there is no period of suspension.

As an exceptional case, we sometimes find that the

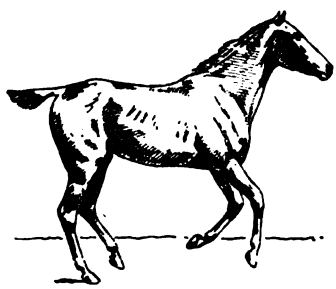


Fig. 146.

CANTER WITH SUSPENSION (HAND GALLOP) (*continued*).

canter of the riding school, when very short and greatly collected, is a pace of four time.

In the canter, the fore leg which does not belong to the diagonal support is called the *leading fore leg*. If, as in Figs. 131 to 146, it be the near fore, the movement is said to be a *canter to the left;* if the off fore, as in Figs. 147 to 155, a *canter to the right;* the reason being that at this pace, or at the gallop, the horse should lead with the leg of the side to which he is being turned or circled. If when leading with the off fore, for instance, he be turned to the left, he will be liable to cross his legs and fall. In the gallop or canter, a horse can cross a fore leg only with the leading leg. We may observe that the hind leg which, in due succession, alone supports the weight of the body, is on the side opposite to the leading fore leg. In the canter shown in Figs. 131 to 137—which with or without a period of suspension, is usually regarded as the typical canter—the supports are the same as the footfalls. In the one portrayed in Figs. 138 to 146, the diagonal support (off fore and near hind, Figs. 139, 140, and 141) does not at any time act unaided (as in the other form of canter, Fig. 133); but is assisted by the other hind leg and the other fore leg in turn. This smooth style of canter might be termed (to use a popular expression) a *hand gallop*. We may note that when there is a period of suspension in the canter, and also in the gallop, it is obtained by the fore-hand being raised by the straightening of the leading fore leg (and especially by that of its fetlock joint), as it quits the ground (Figs. 142 to 144).

The time (three) of the movement shown in Figs. 138 to 146 is irregular; for the interval during which the suspension takes place between the coming down of the near fore and off hind, is longer than either of the other two intervals. Supposing that the speed is the same, and that there is the same interval of suspension in an irregular canter of this kind and in a typical canter, the former would be less distressing to the horse than the latter; for the weight is better distributed in it. The same remarks apply to the canter shown in Figs. 147 to 155, which is a series, from photographs, of an easy canter of a high caste Arab, in which the near hind is on the ground when the left diagonals come down (Fig. 149), and they are supporting the body when the off fore reaches the ground (Fig. 151).

We see, in the canter, that the leading fore has more work to do than the non-leading fore leg. Hence, if this pace be long continued, the horse will often change the leading fore leg.

The Gallop.—This is a pace of four time, in which the feet follow one another in succession, with an interval of suspension between the coming down of the leading

Fig. 147.

Fig. 148.

Fig. 149.

Fig. 150.

Fig. 151.

Fig. 152.

PHASES OF THE CANTER OF A HIGH CASTE ARAB; OFF FORE LEADING.

Photographs by] [M. H. H.

fore foot and that of the opposite hind foot (Figs. 163 to 171). If we compare that series with Figs. 131 to 137, and with Figs. 138 to 146, we shall see that, in the canter, the fore leg of the diagonal support comes to the ground at the same moment (Fig. 132) as, or slightly before (Fig.

Fig. 153.

Fig. 154.

Fig. 155.

PHASES OF THE CANTER OF A HIGH CASTE ARAB; OFF FORE LEADING (*continued*).

Photographs by] [M. H. H.

139), its hind fellow; but, in the gallop, it comes after it (Figs. 158 to 160). We may note that this interval, in which consists the difference between the canter and gallop, is dependent on the extent of the forward reach of the non-leading fore leg. Hence we see that the canter merges imperceptibly into the gallop, and that the difference in these paces, in the same animal, is simply one of for-

Fig. 156.

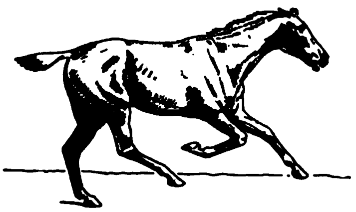


Fig. 157.

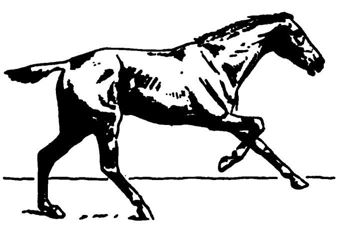


Fig. 158.

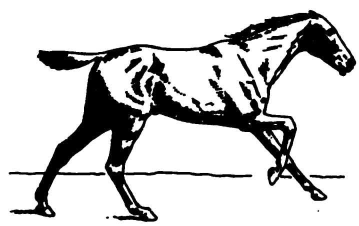


Fig. 159.

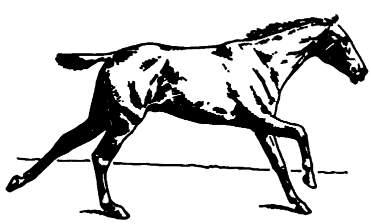


Fig. 160.

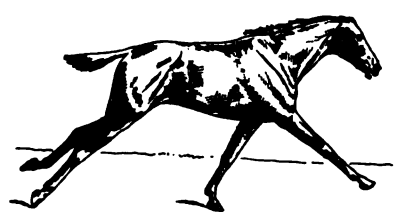


Fig. 161.

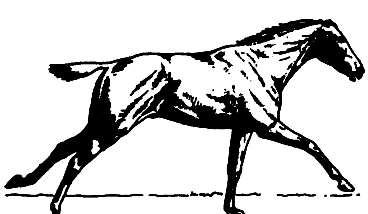


Fig. 162.

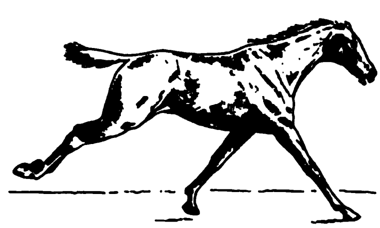


Fig. 163.

PHASES OF THE FAST GALLOP; OFF FORE LEADING.

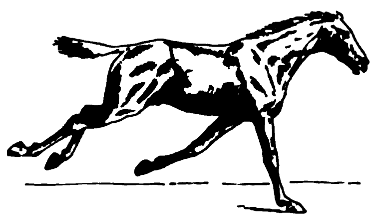


Fig. 164.

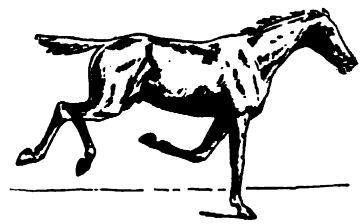


Fig. 165.

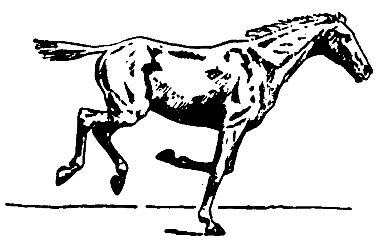


Fig. 166.

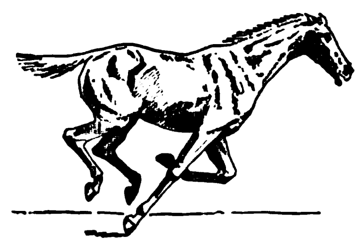


Fig. 167.

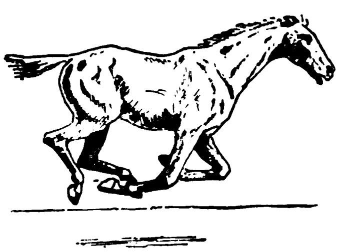


Fig. 168.

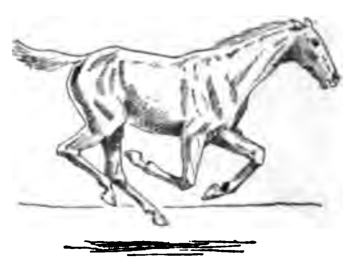


Fig. 169.

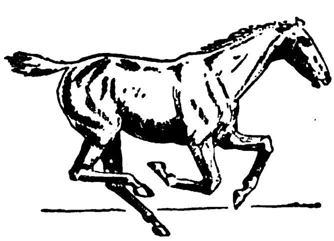


Fig. 170.

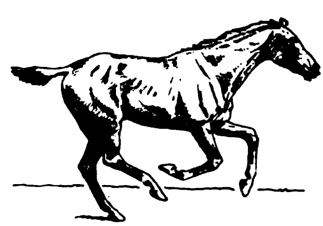


Fig. 171.

PHASES OF THE FAST GALLOP; OFF FORE LEADING (*continued*).

Fig. 172.

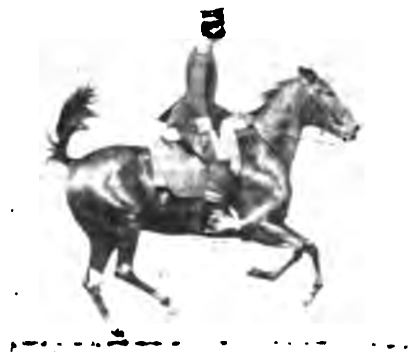


Fig. 173.

Fig. 174.

Fig. 175.

Fig. 176.

Fig. 177.

PHASES OF THE "COLLECTED" GALLOP; OFF FORE LEADING.

Photographs by] [OTTOMAR ANSCHÜTZ, BERLIN.

Fig. 178.

Fig. 179.

Fig. 180.

Fig. 181.

Fig. 182.

Fig. 183.

PHASES OF THE "COLLECTED" GALLOP; OFF FORE LEADING (*continued*).

Photographs by] [OTTOMAR ANSCHÜTZ, BERLIN.

Fig. 184.

Fig. 185.

Fig. 186.

Fig. 187.

Fig. 188.

Fig. 189.

PHASES OF THE "COLLECTED" GALLOP; OFF FORE LEADING (*continued*).

Photographs by] [OTTOMAR ANSCHÜTZ, BERLIN.

ward reach of fore leg—that is, of speed. We may note that the intervals of time between each of these positions represented by Figs. 156 to 171 are all equal. We can see, starting with Fig. 156, that the near hind, off hind, near fore, and off fore (the leading fore leg) remain for nearly the same time on the ground. The leading fore, however, has to perform a longer period of support than any of the other three. It is also more extended when it touches the ground than is the non-leading fore leg,

Fig. 190. Fig. 191.

PHASES OF THE "COLLECTED" GALLOP; OFF FORE LEADING (*continued*).

Photographs by] [OTTOMAR ANSCHÜTZ, BERLIN.

as we shall note if we compare Fig. 163 with Fig. 160. Hence it is more liable than the other limb to suffer from sprains of the suspensory ligament and check ligament (*inferior carpal*), both of which structures aid in supporting the fetlock joint. As regards the injurious effect of concussion, it would appear that the non-leading fore leg (Figs. 159 and 160), by reason of its coming to the ground at a moment when it is wholly unsupported by the other fore limb, would suffer more from concussion than the leading fore. Consequently, I venture to submit that, when the ligaments of the leading fore leg get sprained during the fast gallop, the cause is over-extension, and not the usually assigned one of concussion, or even of sudden jerk. We may also see from Figs. 184 to 189, and from Figs. 152 to 154, how it happens that the back-tendons (especially the *flexor perforans*) of the leading fore, during a gallop or canter in "heavy" ground, are far more apt to become sprained than those of the non-leading fore leg; for, immediately before the period of suspension, they have (on the contraction of their muscles) not only to help in raising the fore-hand by the straightening of the fetlock (Fig. 187), but have also to overcome the resistance which the soil offers to the withdrawal of the foot from its surface.

The "collected" gallop is shown in Figs. 172 to 191.

In the fast gallop, the horse has seldom more than two feet on the ground, and then only for a very brief period. In it, suspension is obtained more by "doubling up" the legs, than by raising the body off the ground.

A horse galloping at speed often brings the toe of the advanced fore foot slightly in front of the end of the muzzle, even at a "collected" gallop (Fig. 180).

The Rein-Back.—This movement to the rear may be executed at the walk or trot, and is performed in a reversed, though exactly similar, manner to the "short stepping walk," or short trot to the front. The so-called *galop en arrière* of the high school is not a canter. It is merely a series of short jumps to the rear.

I wish to draw my readers' particular attention to the two different methods of backward propulsion adopted by the horse, when he makes this movement to the rear. (1) When he is at liberty, or when he reins back "collectedly" with a capable rider in the saddle, he lowers his head so as to put weight on the fore-hand, and pushes himself back by the alternate straightening out of his fore legs; while the hind legs, being comparatively free of weight, are raised higher and with greater freedom than the front ones. It is evident that this high and light action of the hind limbs is as conducive to the safety of the rein-back, as would be the same style of movement of the fore legs in paces of forward progression. (2) When a horse in harness tries to push a heavy weight to the rear, or when he "plants" his hind legs on the ground owing to unwillingness to rein-back or to unskilful handling by his rider or driver, he will make his effort or his "defence," as the case may be, by throwing the weight on his hind-quarters. In the event of the centre of gravity of the horse (and of the rider) falling to the rear of the base of support (p. 60) formed by his four feet, he will, if in saddle, have to make a hurried and consequently a low step to the rear with one hind foot, which may be followed by the other feet in a more or less disorganised and insecure manner. If the hind feet fail to come quickly enough to the support of the centre of gravity, a fall will be the inevitable result. Besides the danger of this rein, or rather run, back, the fact of the hind limbs (which are far less suited to bearing weight than the fore ones) being surcharged with weight, will render them liable to become injured, and will make this movement to the rear far more fatiguing to the animal, than if it were executed in the manner first described. It behoves us, therefore, if we wish to rein-back a horse which we are riding, to adopt the safer and less tiring method. With this object in view, when we want to make a horse which we are riding, rein-back, we should keep our hands "down," so as to allow him, or, if needed, to induce him, to lower his head and put weight on his fore-hand. We should avoid the practice, taught in English riding schools, of taking an equal pull on both reins; for, if we do so, we shall adopt the best means to induce the animal to throw his centre of gravity to the rear, and to adopt the second method of the rein-back, which is objectionable in all cases, except in heavy draught. Instead of this "even feeling" on both reins, we may effect our purpose by, for instance, taking a stronger pull on the near rein, so as to bend the horse's head and neck more or less to the left, draw back the right leg, and touch him with it on the side. The weight then, on account of the head being turned to the left, will be placed more on the near limbs than on the off ones. Consequently, when the off flank is touched by the drawn-back right foot, the animal will, as a rule, readily lift up the off hind foot from the ground, and, feeling the backward pull of the near rein, his natural impulse will be to take a step to the rear with his off hind, and, in order to preserve the previous distribution of weight, he will follow it with his near fore. When the rider has obtained this diagonal step (with the near fore and off hind) to the rear, he can get the other diagonal step (with the off fore and near hind) by slackening the near rein, taking a pull with the off rein, drawing back the left foot, and touching the horse's left side with it; and so on. As each step is obtained, the drawn-back leg of the rider should be brought forward. A straight direction to the rear is maintained by the pressure of the drawn-back leg, whichever it may be at the time. We may see that the tendency of the well-broken horse, when reined back in this way, will be to adopt the diagonal movement (or trot) to the rear. Of all unhorsemanlike proceedings, the practice of "chucking" the animal in the mouth with the reins, to obtain the rein-back, is one of the worst; for it will tend to make him, in his endeavour to escape the painful pressure of the bit (curb or snaffle), throw his weight to the rear and "run back," according to the second method, which is dangerous from a riding point of view. Although the well "collected" rein-back may be done at the walk or trot, the rein-back by the second method is never executed diagonally; for the weight is too unequally distributed to admit of the simultaneous action of an off fore and a near hind, and of a near fore and an off hind. The rein-back in light harness can of course be made in a similar manner to the rein-back in saddle. When the object of the rein-back is to push a great weight to the rear, as in heavy draught, the horse will have to exert his powers in bringing his centre of gravity as far back as possible. Consequently, he ought to have his head well raised, and ought to get his hind feet under him as far as he can without slipping. In this he will be greatly assisted by having calkins on his hind shoes.

Turning and Circling.—Circling is a uniform change of direction executed on a circle in a more or less continued manner. As the movements are nearly similar in both the turn and circle, there is no need to consider them separately.

The horse's fore legs bear more weight than the hind ones, especially during movement and when he is mounted; and are consequently the chief pivots upon which the turn is made. Also, the faster the turn, the greater is the proportion of weight which falls on the inside (near, if the turn is made to the left; and off, if to the right) fore and inside hind leg; because the horse has to lean inwards (Fig. 192), so as to counteract the displacing action of the centrifugal force. When mounted, the horse will have more difficulty in doing this, because the presence of the rider on his back, adds to the weight he has to carry, and raises its centre of gravity. Hence, the rider when turning, especially at the canter and gallop, should lean inwards, so as to help the horse in adjusting his centre of gravity.

As the muscle which draws the fore limb forward, on each respective side, is attached at one end to the humerus, and at the other end to the top of the head and the first four neck vertebræ; it follows that the position of the head regulates the direction in which the fore leg is drawn forward. The head and neck also play an important part as a balancing pole, in adjusting the position of the centre of gravity.

In turning at the walk or trot (say, to the left), the first step to the left had best be taken with the left foot, so as to increase the base of support, and to avoid the inconvenience of crossing the legs. As the leading fore leg, at the canter and gallop, has to support the entire weight of the body for a comparatively long period during each stride, and as it becomes much more extended to the front than the non-leading fore leg; the horse, in order to turn comfortably and safely at these paces, should lead with the inward

Fig. 192.—Turning at Polo.

fore leg. Thus, we see that the pony which is turning to the left in Fig. 193, is leading with his near fore; and the one which is turning to the right in Fig. 194, is leading with his off fore. If a horse leads with the outward leg when turning at the canter or gallop, he is very apt to cross his legs and fall. In order that the leading fore leg may have full forward reach when turning at these paces, the rider should avoid bringing the horse's head round to the inward side; because, if he does this, he will shorten the distance between the points of attachment of the muscle which draws the leading fore leg forward, and will thus curtail its action. As the indication to turn, has, as a rule, to be given with the inward rein, it is always well for the rider to try to check any inward bending of the head or neck, by pressing the outward rein against the outward side of the neck, as in Fig. 193. The chief value of the running martingale

Photo by] [JOSIAH NEWMAN.

Fig. 193.—Nondescript Bending.

consists in the fact that it prevents the outward rein, when employed in this manner, from going too high up on the neck of the horse.

Buck-jumping is evidently an instinct which the wild ancestors of our present horses acquired, in order to rid themselves of the carnivorous enemies that pounced on their backs. Naturally, the longer a breed of horses has been under the influence of domestication, the less inclined are its members to buck. I have ridden many bad buck-jumpers among horses which were bred

Photo by] [JOSIAH NEWMAN.
Fig. 194.—Game Chicken Bending.

in a more or less wild state in Australia, New Zealand, North and South America, South Africa and the Russian steppes; but I have never known English, Irish, East

Indian or Arab horses buck. I remember that almost every "green" Australian horse which was imported into India forty years ago, was a buck-jumper; but this vice has now become much rarer among Australasian horses, owing to their being reared under more civilised conditions. In describing this vice, I cannot do better than repeat what I have said about it in *Riding and Hunting*. The buck-jumper with the quickness of thought, throws his head between his fore legs (Fig. 195). At the same moment he arches his back, bounds in the air with his head and shoulders down, his fore legs thrust straight out to the front, and his hind legs gathered under him (Fig. 196). The difficulty in sitting him consists chiefly in the fact that the suddenness of the downward movement of his head is very apt to cause the rider to be pulled forward on to his neck, by means of the reins, and that the shock of the impact of the fore legs with the ground and the violent cant of the loins will, in such a case, generally complete the disconnection. The regular buck-jumper will buck forwards, to one side, or even backwards, until he dislodges his rider. Or, not content with this, he may go on until he breaks the girths, gets through the saddle, or tires himself out. When he succeeds in breaking the girths, he usually does so by getting the saddle on to his neck during his convulsive movements, and then, when he throws up his head, something *must* go. No matter how strong a seat a man may have, he will be almost certain to part company with his mount, if in the first instance he makes the mistake of "hanging" on to the reins. I can say from experience that when a horse bucks, the rider suddenly becomes aware that there is nothing in front of the pommel of the saddle except a sheer precipice, and feels himself jerked forward without having anything to hold on to. In the Colonies, a horse is said to "pig-jump," when he bucks only forward; but if he supplements that movement by the still more disconcerting action of bucking to one side or

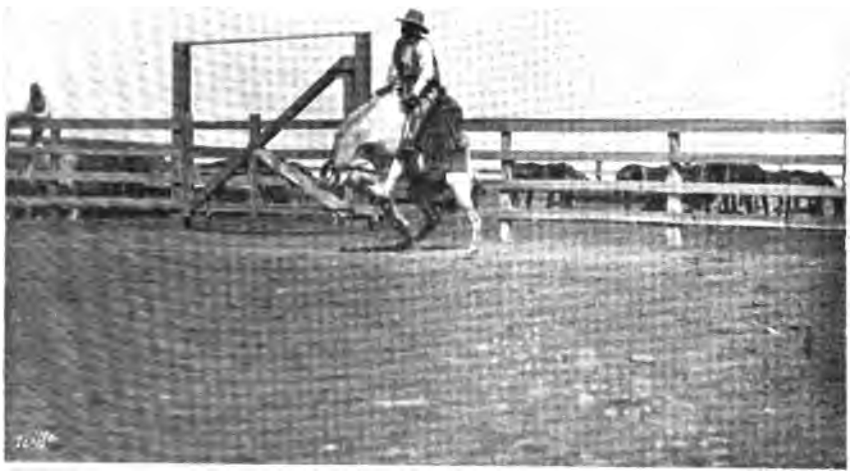


Fig. 195.—Texas Broncho Buck-jumping.

Fig. 196.—Texas Broncho Buck-jumping.

backwards, he can fairly claim the distinction of being able to buck-jump. The majority of buck-jumpers buck as soon as they are mounted ; but others do so, only when they are startled in some peculiar manner. For instance,

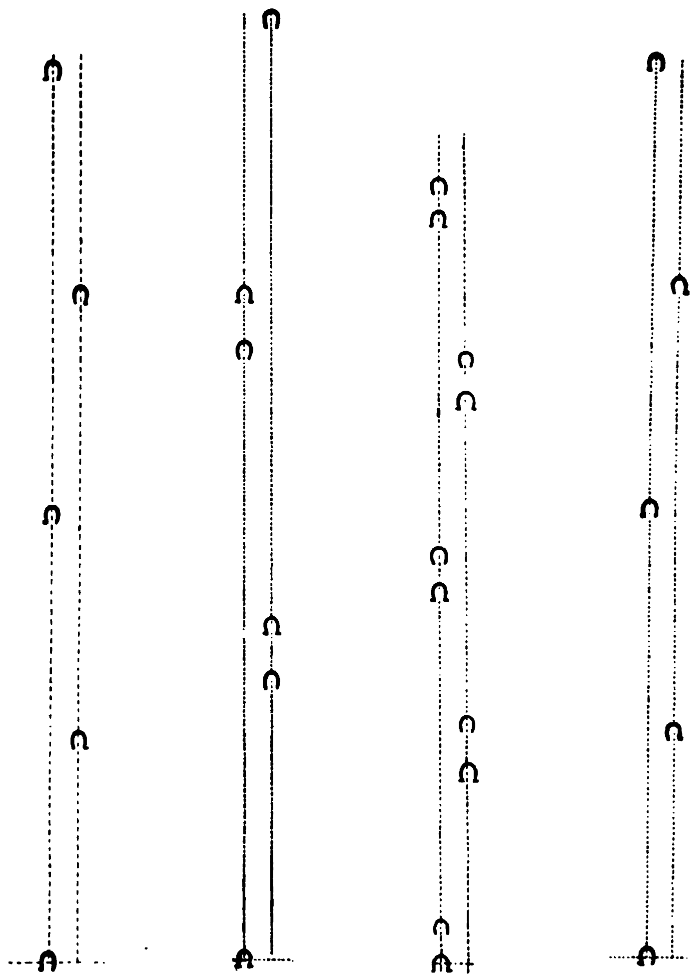


Fig. 197. Ordinary Walk. Fig. 198. Long-striding Walk. Fig. 199. Short Trot. Fig. 200. Slow Trot.

an Australian steeplechase mare which I owned and rode in India, invariably bucked, if, at any time, she heard the rustling of a letter or other piece of paper I happened to take out of my pocket when on her back; but she never "played up" on other occasions.

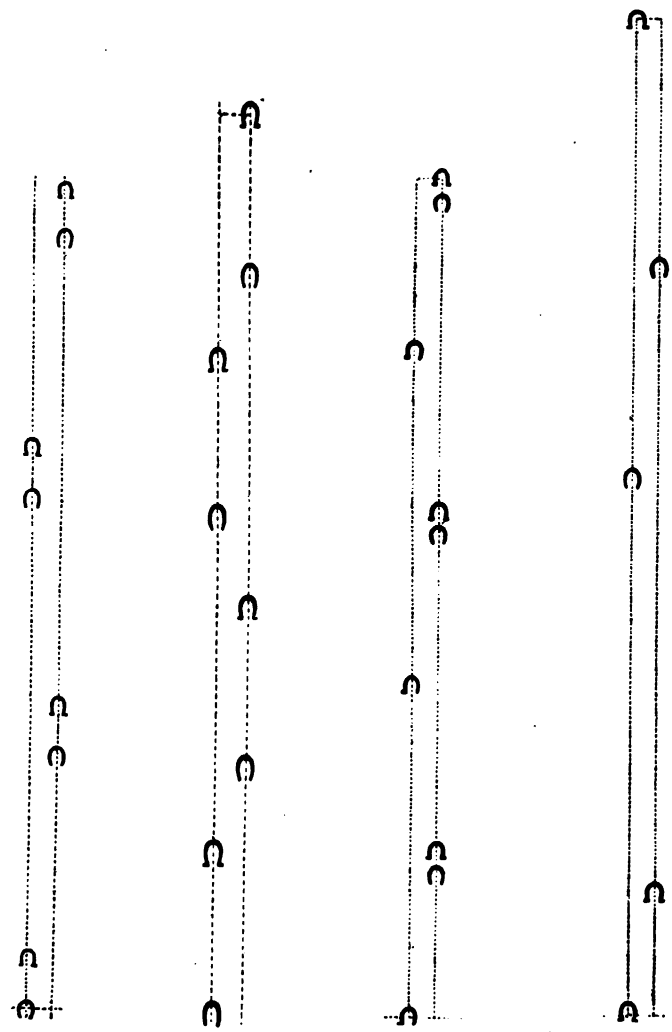


Fig. 201. Fast Trot.

Fig. 202. Slow Amble.

Fig. 203. Slow Canter.

Fig. 204. Fast Gallop.

Shying of the ordinary kind is an instinct common to many species of animals; but some horses shy, by making a sudden bound to one side, the moment they see their cause of alarm, which, in a horse I owned, was any white object. This very rare form of shying is probably inherited from wild ancestors.

Foot-prints of the Horse during various Paces.—In the study of the foot-prints of the horse we are struck with two notable facts: (1) The faster the pace, the greater tendency has the hind foot to be placed beyond the fore foot of the same side. Here we have the influence of instability of equilibrium in increasing the speed (p. 69). (2) The faster the pace, the nearer do the foot-prints of all four feet tend to come into the line of direction in which locomotion takes place. As Lenoble du Teil expresses it, the foot-prints of the race-horse at full speed resemble the marks that would be made by the spokes of a wheel which had no felloes. In this case, the line of the foot-prints will be more or less in the line of progression, and consequently the loss of propulsion from lateral deviation will be reduced to a minimum. This fact proves the undesirability, from a speed point of view, of any undue width between either the fore or hind legs (p. 68). In Figs. 197 to 204, for which I am indebted to Barrier and Lenoble du Teil, the left-hand dotted line of each diagram shows the direction of the prints of the near feet; and the right one, those of the off feet. In Figs. 197 and 200 the prints of both fore feet are covered by those of the hind feet. In Fig. 203 the prints of the near fore foot are covered by those of the near hind foot. In these figures, only the succession of the foot-prints has been noted, but the lateral distances between the respective lines of direction of the near and off feet have not been marked.

The length of stride in the canter is about 12 feet; that of the full-speed gallop of the race-horse, about 24 feet. The stride of Dan Patch, the famous American pacer, when pacing at full speed, was found to measure 21 feet.

CHAPTER XIII.

LEAPING.

Definition of the Leap—Varieties of the Leap—Difference between the Horse's Leap and the Suspension of his Body during the Canter or Gallop—Manner in which a Horse takes off—Period of Stride at which the Take Off is effected—Effect of Pace and Speed on the Leap—Clearing a Fence—Landing over a Jump—Influence of Blood in Jumping.

Definition of the Leap.—The ordinary leap or jump is the projection of the body off the ground by means of the straightening of the hind limbs, after the fore-hand has been raised.

Varieties of the Leap.—We may divide the leap into the *running jump* and the *standing jump*; and each of them into the *high leap* and *long leap*, which are differences merely of degree.

Difference between a Horse's Leap and the Suspension of his Body during the Canter or Gallop.—In the leap, the period of suspension takes place when the hind legs quit the ground; in the canter or gallop, when the leading fore leg is raised (compare Figs. 224 to 228 and Figs. 234 to 237 with Figs. 153 to 155, and with Figs. 187 to 191). It is instructive to note that a definition founded on this difference is not of general application to other animals. In the gallop of the greyhound, there is a period of suspension (Fig. 209) similar to that of the horse's leap, as well as one (Fig. 206) like that in the horse's gallop. It seems that the former is longer than the latter in the full-speed gallop of the greyhound.¶ It appears that if this dog begins

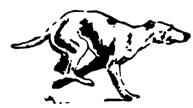


Fig. 205.

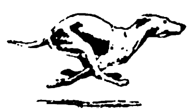


Fig. 206.

Fig. 207.

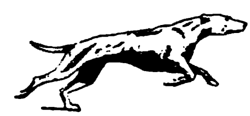


Fig. 208.

Fig. 209.

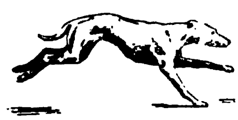


Fig. 210.

Fig. 211.

GALLOP OF THE GREYHOUND, SHOWING TWO PERIODS OF SUSPENSION.

Fig. 212.

Fig. 213.

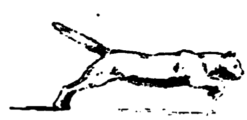


Fig. 214.

Fig. 215.

Fig. 216.

Fig. 217.

GALLOP OF THE CAT, SHOWING ONE PERIOD OF SUSPENSION.

his stride on one fore leg, the right for instance (Fig. 205), he will after his two periods of suspension (Figs. 206 and 209) "take off" from the opposite fore leg, the left (Fig. 211) in this case. If this be true, his stride (counting it as the interval between the supports of the same leading fore leg) will include four periods of suspension. In the gallop of the cat (Figs. 212 to 217), and also in that of the tiger, panther, and cheetah, the leaping form of suspension appears to be the only one present. Unfortunately I have not had an opportunity of observing the paces of other large felines. The Indian black buck and the South African springbok, which are two remarkably fast kinds of antelope, generally begin their gallop by a series

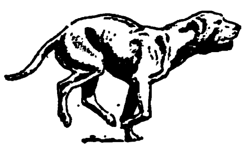


Fig. 218.

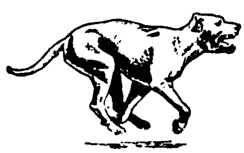


Fig. 219.

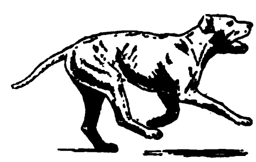


Fig. 220.

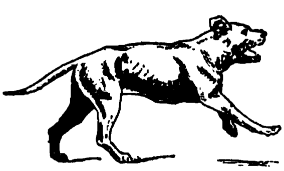


Fig. 221.

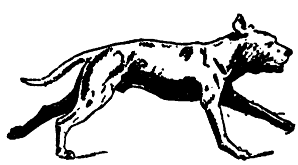


Fig. 222.

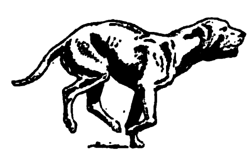


Fig. 223.

GALLOP OF THE HEAVY DOG.

of leaps, when suddenly startled. The gallop of the mastiff (which is a comparatively slow dog), depicted by Figs. 218 to 223, resembles that of the horse. We may note that the longer the period of suspension, the faster and more fatiguing, as a rule, will be the gallop.

Figs. 224 to 228 show photographs of the leap from taking off to landing.

Manner in which a Horse takes off.—In the canter or gallop, the animal makes his preparation when he supports his body on his leading fore leg (Fig. 229), by straightening which (and especially its fetlock joint) he raises his fore-hand. At the same time, he brings one hind leg down (generally that on the same

Fig. 224.

Fig. 225.

Fig. 226.

PHASES OF THE LEAP.

Photographs by] [M. H. H.

side as the leading fore), followed by the other hind (Figs. 230 and 231), and, by straightening them out (Fig. 234), projects the body upward and forward (Fig. 235). There is, practically, no period of suspension (Figs. 230 and 231)

Fig. 227.

Fig. 228.
PHASES OF THE LEAP (*continued*).

Photographs by] [M. H. H.

between the removal from the ground of the fore leg that supported the weight, and the putting down of the hind leg which first comes on the ground.

In Figs. 243, 244 and 245, we see how a horse "takes off," by straightening the joints of his hind legs.

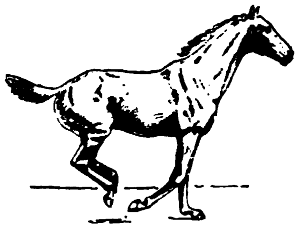
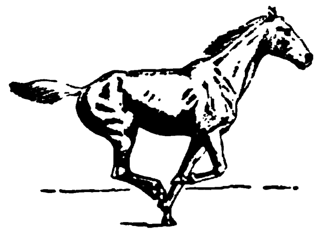


Fig. 229.



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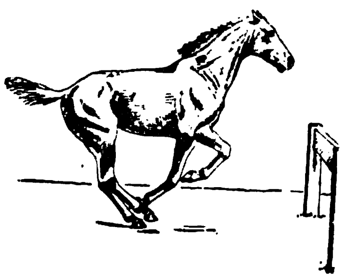

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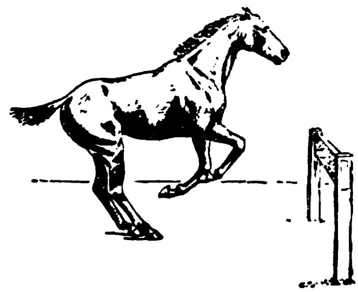

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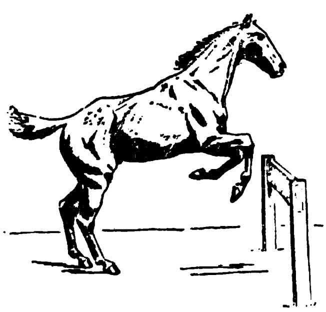

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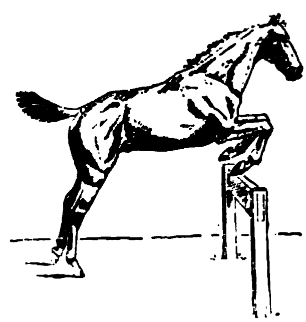


Fig. 234.

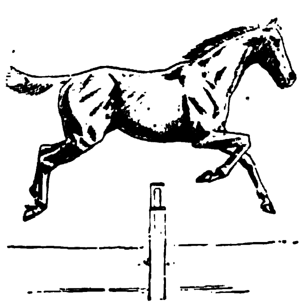


Fig. 235.

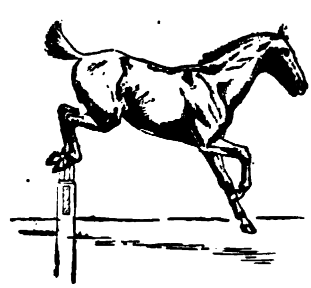


Fig. 236.

THE HORSE'S LEAP.

From the halt, the horse prepares to leap by making a rear (p. 95), and projects himself forwards and upwards when he has raised his fore-hand sufficiently high.

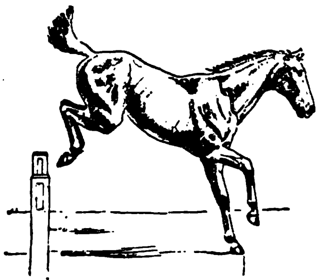
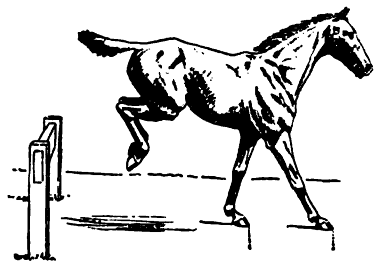


Fig. 237.



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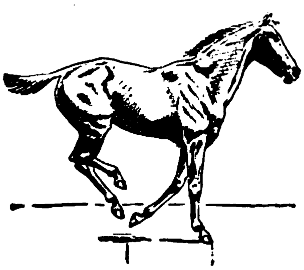

Fig. 239.

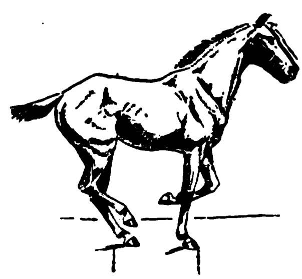

Fig. 240.

Fig. 241.

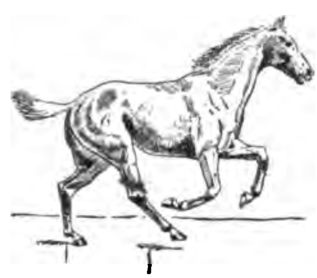

Fig. 242.

THE HORSE'S LEAP (*continued*).

From the walk, trot, or amble, he takes off from either fore leg, and brings the hind legs under the body as may be required.

Period of Stride at which the Take Off is Effected.—In the running leap from the canter or gallop, we may regard the putting down of the leading fore leg (Fig. 229) as the commencement of the take off; for, at that instant, the character of the pace is changed, and the " take off " by the hind legs is made close to the foot-print of that leg. We therefore see that during the stride of, say, from four to seven yards in length,

Photo by] [K. E. HAN, CZARSKI SELO.

Fig. 243.—Taking Off.

there is only one moment at which the " take off " can be executed. Hence, if a horse does not regulate the length of his stride when coming up to a fence, he may easily make a mistake. Let us suppose that, while taking a stride of five yards, he brings down his leading fore leg three yards short of the proper spot at which he ought to take off; he will then have to jump three yards " bigger," or chance an accident by taking off two yards too near. The longer the stride, the greater will be the tendency to this error. Consequently, other things being equal, a short-striding horse will be safer over a "cramped" country than a long-striding one. Also, we may say that no horse merits the title of "a safe conveyance," unless, when coming up to a jump, he accurately regulates the

Photo by] [M. H. H.
Fig. 244.—Cloister and Horizon jumping open ditch at Sandown Park.

length of his stride, and "puts a short stride in," when required.

In the trot or amble, the putting down of the fore foot which is the last to quit the ground, may be looked upon as the beginning of the take off.

Effect of Pace and Speed on the Leap.—The running jump is usually executed at the canter or gallop.

A few horses can leap (especially height) cleverly from the trot, which is a useful accomplishment in a hunter; for it may enable him, when in a difficult position (as when jumping out of a lane), to utilise a "run" which would be too short for the longer stride of the canter or gallop. Besides, at these paces there is only one period of the stride at which the animal can take off (pp. 148 and 149); but in the trot there are two such periods, namely, when the respective diagonals come to the ground. A horse, however, cannot jump so freely and "big" from the trot as from the canter or gallop, in each stride of which, the hind legs are brought nearly together under the horse's body (Figs. 153 and 187), ready, if need be, to change the pace into the leap (Fig. 229). In the trot, each hind limb moves harmoniously with its diagonal fore leg; but in the opposite direction to its hind fellow.

In examining the various kinds of the leap of the horse, we must remember that he has a long distance (that from his hocks or buttocks to his muzzle) of body to carry over a fence, independently of raising it to a sufficient height; hence his high jump partakes much more of the long jump than the high jump of a man, whose body is carried more vertically than horizontally. For this reason, it is more essential for a horse than for a man to "get up" a fair amount of speed, in order to jump height well.

The speed at which a horse goes at a jump (supposing that it does not prevent him from "collecting" himself properly), influences the width he can clear; because (as we have seen on p. 64) the force by which he is projected forward into the air is equal to the force of propulsion derived from his limbs, *plus* the impetus due to the speed at which he is going. The greater this impetus, the smaller will be the "angle of projection" at which the centre of gravity of the body is propelled forward.

We may, with approximate accuracy, define the "angle of projection," as the angle which a line passing through the centre of gravity and a point midway between the prints of the two hind feet, makes with the horizontal plane, at the moment when the body leaves the ground.

Looking at the subject from a hasty point of view, persons who have not had practical experience, might come to the conclusion that a horse would jump height as well when going fast as when going slow, and that the

Photo by] [C. H. HARRIS, WAIPUKURAU, N.Z.

Fig. 245.—New Zealand Horse, Marengo, jumping wire, and ridden by Mr. J. W. Harding.

only difference is, in the former case, that the animal would be obliged to take off further from the fence than in the latter. This supposition, however, does not hold good; for the faster the pace, the more weight is thrown on the fore hand, and the greater difficulty will the leading fore leg have in raising the fore-hand off the ground. Hence, even without the valuable experience of the hunting field and steeplechase course, we may accept the truth of the old saying that we should ride slow at "timber." Also, I am inclined to think that a horse will not clear as great a width when taking a water jump, if he is sent at his topmost speed at it, as he would do, were his rate of going slightly moderated, so as to enable him to raise his fore-hand sufficiently off the ground, in order to obtain the angle of projection which will enable him to cover the maximum distance.

Clearing a Fence.—It is evident that the more a horse, in the leap, brings his hind feet forward as compared to the position of the prints of the fore feet, the greater will be the angle at which he can, at the speed he is going, project his body upward. Also, the more he raises his head, the more will he, by bringing back the centre of gravity, increase its angle of projection. Besides, as the forward and upward movements of the fore limbs depend on the action of the muscles of the neck, the direction in which the fore legs will be raised, will naturally depend on that of the neck. A horse, therefore, when approaching a fence which will tax his powers to clear, should regulate his speed, so that the impetus obtained from it may be in due proportion to the propulsion derived from the limbs; should bring his hind feet well under his body; and should hold his head high. I am here supposing that the animal takes off at the correct distance from the obstacle. These actions constitute, as regards the horse, what is popularly and somewhat vaguely called "collecting" himself.

We may note that although, when preparing to leap, the hind legs are brought down on the ground in a straightened-out position (Fig. 231), and leave it in the same attitude (Fig. 234); they are somewhat bent at the hocks and stifles (Fig. 233) at a time intermediate to these two moments. Hence, we see from these drawings that the propulsion from the hind legs in the leap is due to their being suddenly straightened out, in which action, the fetlock joint also plays an important part.

As the ability to clear height depends greatly on the power of raising the fore-hand; the rider should refrain from leaning forward when the horse is rising at an obstacle. He should, on the contrary, lean more or less

Photo by] [C. H. HARRIS, WAIPUKURAU, N.Z.

Fig. 246.—New Zealand Mare, Javlina, jumping wire, and ridden by Mr. A. M. Harmer.

back at this moment (Fig. 224), so as not to put any avoidable weight on the fore-hand.

In almost all cases of the well-executed high jump, the fore legs are bent up together and the hind ones fully straightened out at the moment of taking off (Fig. 243). The fore legs will be kept more or less in this position till the fence is cleared. If the obstacle is "stiff" and the horse hits it with his knee or fore-arm, he will probably fall; but if any part of the leg below the knee strikes it, he will generally get over all right, or with a "peck" at most. Hence, a clever horse will try to avoid an accident by raising his knees well out of harm's way. Another danger consists in the horse catching the fence with his hind legs, which he will best avoid by bending them as much as possible at the stifles and hocks (Fig. 246). Consequently, a clever jumper, as soon as his hind legs quit the ground when taking off, will tuck them under him as if they were on springs

Photo by] [THE GRESHAM STUDIO, ADELAIDE, S. AUSTRALIA.

Fig. 247.—Mr. B. White's Australian hunter, Silver.

suddenly let go, after having been drawn out. A slovenly fencer, on the contrary, is liable to drag his hind legs after him, at the imminent risk of catching them in the fence and falling. In a high jump, the animal should keep his hind legs well bent until he is clear of the obstacle (Fig. 248), so that, if need be, as might occur in the case of an unexpected wide drain being met with at the landing side, he may be able to strike the landing side of the fence with his hind feet, and thus give himself a fresh forward impulse.

When a horse is suspended in the air during a leap, he may move his limbs or retain them in one position, according to what he feels to be most conducive to his safety.

Photo by] [C. H. HARRIS, WAIPUKURAU, N.Z.

Fig. 248.—New Zealand Horse, Marengo, jumping wire, and ridden by Mr. J. W. Harding.

Landing over a Jump.—The prettiest style, and safest manner, of landing in the leap, is for the two fore legs to be kept straightened out and comparatively close together until they are near the ground, when one of them comes down, and is followed by the other (Figs. 249, 250 and 251), which is placed a little distance in front of it. This method of landing may give the impression to the observer that the horse comes down on both fore feet at the same time. The plan of landing with the second fore leg considerably bent, is not so safe as that of keeping it straight ; for in the event of any falter being made by the supporting fore leg, the other fore leg will be better prepared to save the horse from a fall, if at that moment it be straightened out, and not bent.

It is evident that, for safety, the knee of the leg upon which the animal lands, should be as straight as possible ;

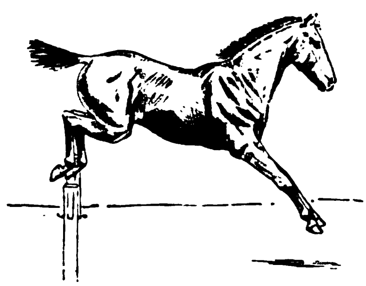

Fig. 249.

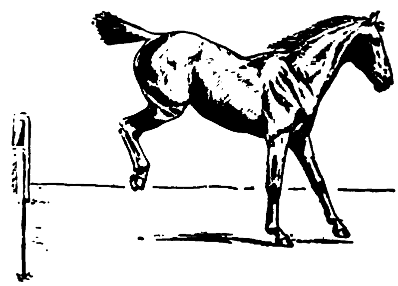

Fig. 250.

Fig. 251.
LANDING.

for if the knee "gives," the horse will almost certainly fall. Hence, we should regard the condition of being "over at the knees" (p. 280) as a grave defect in the jumper, especially if he be required to go fast.

As a rule, when landing over a jump, the hind foot which first comes down, has been made way for by the fore foot of the same side, somewhat beyond the print of which it is placed. The other hind foot and the other fore foot act in a similar manner. We may see from Figs. 238 to 242, that a horse "gets quickly away from a jump" by raising the fore-hand, which is accomplished by the straightening out of the fore limbs. The

Fig. 252.

Fig. 253.

Fig. 254.

GETTING AWAY AFTER LANDING.

Photographs by] [M. H. H.

rider should, therefore, avoid throwing any undue weight on the fore hand at this moment. It sometimes happens that a horse "over-reaches" (strikes a fore leg with a hind foot) when landing over a jump, on account of the rider being jerked on to the animal's neck; the injured fore leg having been prevented from getting out of the way of its hind fellow by the surcharge of the fore-hand. The heavier the fore-hand, other things being equal, the farther forward, when landing over a jump, will the hind feet be carried as compared to the fore feet; and *vice versâ*. Hence, the faster the pace, the greater will be the tendency to over-reach. This is especially the case in jumping water, at which, not only is the speed as a rule high, but the ground on landing is often soft and "holding" from the infiltration of moisture. It is evident that the "deeper" is the ground, the more difficult it will be for a horse to extricate his fore feet out of it, in time to make way for his hind feet. Hence the advisability, in such cases, of leaning well back in the saddle. Figs. 252, 253, and 254 show consecutive movements of the horse after landing over a jump.

A horse should not land with his head and neck bent, as might be caused by the action of a severe bit which he is afraid to "face"; for when the neck is bent, the muscles which draw the fore legs forward and enable them to reach well to the front (p. 43), will be more or less thrown out of action. Therefore, the rider ought to give the horse plenty of rein on landing, and should try to avoid bringing his weight forward. As an interesting point in the action of a severe bit in leaping, I may mention that if we observe a horse that is being ridden up to a high jump in a bit which he is afraid to "face," he will land, in the event of his clearing the obstacle, more or less on all four legs at the same time, in his endeavour to save his mouth from any sudden "job," by keeping the weight as much as he can off his fore-hand. He may act in the same way, even with a snaffle, if a short running martingale be used. The two "defences" which a horse generally uses against a severe bit, are to poke his nose up in the air, and to draw his chin in towards his chest, and thereby arch his neck. Many persons, against the evidence of photography, assert that a clever jumper will generally land first on his hind legs, and will then (so they say) be in the best position to "get away" quickly. They quite forget (or perhaps do not know) that the hind limbs of a horse are unfitted to stand the violent shock which would be transmitted through them, if they had to bear the weight of the body on landing. These limbs are such poor weight-bearers, that a horse, as a rule, has

Photo by] [THE GRESHAM STUDIO, ADELAIDE, S. AUSTRALIA.

Fig. 255.—Australian horse jumping.

great difficulty in walking even a few yards on his hind legs. Almost all circus horses which have to perform this trick, throw out, after a short time, curbs, spavins and thoroughpins of amazing size. What a state the hocks of a hunter or chaser would be in, if he had always to land first on his hind legs! The fore limbs, on the contrary, being attached to the body only by muscles, are singularly well adapted to support shock, like that of landing over a fence. Besides, if a horse, which, like all other animals, is obliged to "take off" from his hind legs, were, also, to land on them, he would lose all the advantage which the forward reach of his fore legs gives him. As we have already seen, a horse in the gallop, after the period of suspension, lands on a hind leg; but in the leap, he lands on a fore leg.

When a horse lands on both fore feet nearly at the same time (Fig. 255), he will jump more or less "sticky," which many animals are prompted to do, by having to draw in their heads on landing, so as to save their lower jaw from the painful pressure of the curb. In a well-executed leap, the fact of the horse landing on one fore leg and then on the other, lengthens the base of support, and thus increases the stability. The hind legs coming down in the same manner enables the horse to at once take up the gallop, which is in four periods, without loss of time (Fig. 242). The safest way for a man, on the contrary, to alight is on both feet kept together, with the knees somewhat flexed (Fig. 41), in order to break the shock of concussion; for his body is placed vertically, and not horizontally, as is the case with the horse. In drawing any comparison of this kind, we must remember that our legs are attached to the trunk by bony union, at our hip joints, and not, as in the fore legs of the horse, by muscles which act as springs in nullifying any injurious effect from impact with the ground. Again, in the horse, although the knees must be kept straight, on landing, in order to insure stability; the fetlock, elbow and shoulder joints act as springs. As man is a plantigrade animal (one that walks on his hocks; p. 38), he must utilise the "play" of the knee joints, with which to break the force of concussion, when he lands on the ground with any great force. If, in such a case, the knees be kept straight, the shock will fall in its entirety on the pelvis, at the hip joints, and may be transmitted with very serious effect to the spinal cord. Men who practise hurdle-racing on foot (Fig. 256), alight on one foot, and then bound off on to the other; as their great object is to lose no time in getting away from their fences, which, being comparatively low, do not greatly affect the athlete's stability.

We may see from the foregoing considerations, that for safety and quickness in "getting away" after a leap, it is essential for the fore legs to be removed out of the way of the hind feet, and for the fore-hand, which was previously depressed by the weight of the body falling on it (as in Fig. 238), to be raised by the straightening of the fore legs (Figs. 239 to 242). These two actions

Fig. 256.—Mr. G. R. Garnier winning 120 yards hurdle race.

have of course to be performed with speed and precision. Hence, it is necessary for the horse to see where he is going to place his feet on landing; so that he may be prepared for the required movements of the limbs. If he be prevented from knowing when his feet will come down on the ground, there will be loss of time in calling the muscles of the limbs into action, and the probability of an accident will be greatly increased. A common way some inexpert riders have of making a horse, when jumping, fall or over-reach in this manner, is to "throw up their hands," and thus cause the animal to unduly raise and extend his head, which he does with the object of "saving" his mouth; the result being that the horse cannot accurately see where he is going to put his feet. The rider, on the contrary, should keep his hands low and should give his mount plenty of rein, so as not to interfere with the animal's movements when landing.

Influence of Blood in Jumping.—Seeing the manner in which the rate of speed influences the extent of the long jump, we may reasonably conclude that a fast galloper, other things being equal, would jump a greater width than a slow horse. The possession of great galloping speed, however, would not, of itself, materially assist the high jumper. I regret to say that I have no exact data to go on; but my own experience leads me to conclude that the majority of big water-jumpers will be found among well-bred horses. As the height or distance over which the body is propelled by the limbs, depends on the speed at which they are straightened out; we shall find that a horse which is quick in his movements, other things being equal, will jump higher and broader than another which is slower. For this reason, the thorough-bred, properly selected and trained, will make the best of all jumpers, over height as well as over length.

CHAPTER XIV.

NOTATION OF THE PACES OF THE HORSE.

THAT distinguished French savant, M. Marey, published in 1878 his researches on the paces of the horse. He carried them out by means of a registering apparatus somewhat similar to the one, the sphygmograph, used by doctors for recording the movements of the pulse. The machine consisted of a cylinder which was made to revolve by clockwork. Attached to it were four pointed levers that were arranged so as, when pressed upon, to trace lines on a sheet of blackened paper. Each of these levers was provided with an india-rubber tube, which communicated with a rubber ball filled with air and fixed on the ground surface of one of the animal's feet. These levers and their connections were made so that, when the horse during movement put a foot on the ground, the rubber ball attached to that particular foot would be compressed, and the air rushing into the tube would raise the lever and bring its point against the sheet of blackened paper. When the animal lifted its foot from the ground, the air would go back into the ball, and allow the point of the lever to be taken off the surface of the paper. As, while this was being done, the cylinder revolved at a uniform rate of speed, it follows that the line traced by each lever point would be a record of the duration of the contact of the foot with the ground, and that the intervals between two such contacts would be a measure of the time the foot was suspended in the air. By this means, Marey investigated the nature of the paces of the horse. He also devised the following very ingenious method of representing them on paper.

If we wish to express on paper the running pace of a man, we may do so by making a scale with rectangles, which, for the sake of convenience, we may use instead of Marey's lines. Thus, if the time of contact be about equal to that of suspension, Fig. 257 will express the nature of the pace. To render this figure more graphic, plain rectangles have been used to mark the supports of the left foot; and shaded ones, those of the right foot. If we desire to represent the ordinary walk of a man in the same manner, we shall be confronted with the difficulty that,

Fig. 257.—Run of Man (Figs. 30, 31 and 32).

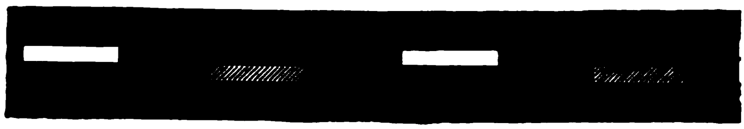

Fig. 258.—Run of Man (Figs. 30, 31 and 32).

Fig. 259.—Walk of Man (Figs. 25, 26 and 27).

Fig. 260.—Slow Trot without Suspension.

Fig. 261.—Ordinary Trot with Suspension (Figs. 64 and 67).

Fig. 262.—Fast Trot (Figs. 68 to 72).

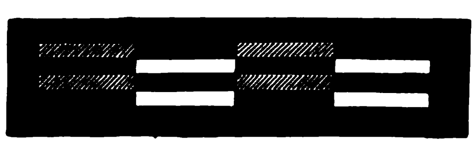

Fig. 263.—Slow Amble without Suspension.

Fig. 264.—Flying Amble (Figs. 93 to 97).

Fig. 265.—Typical Walk.

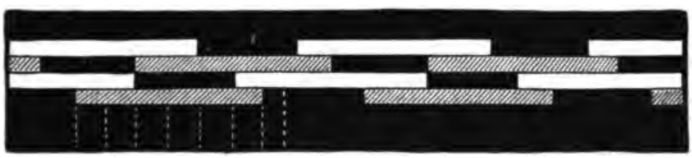

Fig. 266.—Ordinary Walk (Figs. 110 to 117).

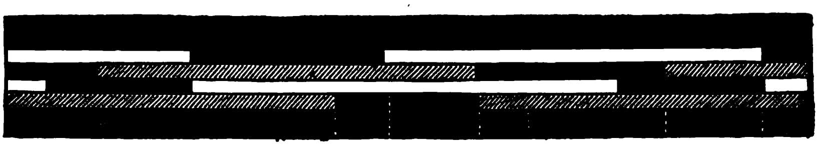

Fig. 267.—Slow Walk in Draught (Figs. 124 to 130).

Fig. 268.—Typical Canter with Suspension.

Fig. 269.—Typical Canter without Suspension (Figs. 131 to 137).

as both feet are on the ground at certain periods of this pace, the rectangles would naturally have to overlap each other. We may, however, get over it by placing the diagrammatic prints of, say, the left foot on a line above those of the right foot. In this manner, in order to represent the run, we would place these footprints as they are shown in Fig. 258 ; not as in Fig. 257. We may indicate the walk by Fig. 259, in which I have assumed that both feet are on the ground for one-sixth of the period of support of each foot.

We must remember that these scales or notations give us only the order of succession of the feet, and their respective and proportionate periods of support and suspension ; but they do not furnish us with

Fig. 270.—Canter with Suspension (Figs. 138 to 146).

Fig. 271.—Fast Gallop (Figs. 156 to 171).

Fig. 272.—The Leap (Figs. 229 to 242).

a clue to the speed of any particular pace, except that, when there is a period of suspension, the longer it is, the greater, as a rule, will be the speed.

To construct the respective notations of the various paces of the horse, we may employ the rectangles of Fig. 257 for the fore legs, and may use similar ones, placed underneath them, for the hind legs. Thus, Fig. 261 will give us the scale of the trot as shown by Figs. 64 to 67.

My readers will notice that the dotted lines on Fig. 262 mark the respective moments at which the horse assumed the positions depicted in Figs. 68 to 72. In the remaining notations in this chapter I have similarly marked the connections between these scales and the corresponding figures in Chapters XII. and XIII.

CHAPTER XV.

COMPARATIVE SHAPE OF HORSES.

General Remarks—Relations between Height and Length of Body—Comparative Height at Withers and Croup—Points in Common—Limit of Height—Thickness of Limb—Length of Neck—Length of Head—Comparative Weight of Body—Comparative Length of the Bones of the Limbs—Differences of Conformation between the Two Sexes.

General Remarks.—In order to simplify comparison and to prevent tedious repetition, we may divide horses, from a conformation point of view, into (1) horses of speed, and (2) horses of strength; and each of these classes into (*a*) saddle horses, and (*b*) harness horses. Thus, we have the speedy saddle horse in the *flat-racer;* the speedy harness horse in the *match-trotter;* the strong saddle horse in the *weight-carrying hunter* and *trooper;* and the strong draught horse in the *Shire* or *Clydesdale.* I shall therefore contrast, in this chapter, "points" of speed with those of strength; and the differences between horses intended for the saddle, and those required for work in the shafts. English and Colonial lovers of horses will demand a further distinction—to which I shall do my best to attend—between flat-race horses and cross-country horses. In general terms, the outcome of this research will be a more or less successful investigation into the "points" of the race-horse; hunter, trooper, or riding hack; match trotter; light harness horse; and heavy cart horse. Later on, an attempt will be made to show that all riding hacks and cavalry horses should possess the jumping points of the hunter. It is evident that the steeplechase horse should be a judicious combination of the hunter and the race-horse. The fast horse, whether racer or American match trotter, can no more dispense with a certain amount of strength, than can the heavy draught horse attain excellence without a certain amount of speed, even at a walk. The light vanner belongs to a class intermediate between the light harness horse and the heavy draught horse.

The method of working from the whole to a part, should be followed as rigorously in judging a horse, as in painting or land surveying. If we desire to obtain correctness in these arts, we must, as a rule, first get our general outline, and then fill in the details. If, in our preliminary examination, we allow our eyes to be caught by some isolated beauty or defect, we would be—to use an oft applied simile—like a painter who begins a full-length portrait of a person by drawing the nose, and then hangs the remainder of the body to it. We should bear in mind that the degree of adaptability of an animal for any special kind of useful work, depends more on his general shape, than on the possession or absence of any particular "point."

In making comparisons, we should not be disconcerted by the fact that some of the proportions of a horse may vary a little according to the position in which he stands and the nature of his bodily condition. Some allowance has to be made for the fact, that the majority of the fast horses and jumpers in the illustrations of this book, were taken when they were in hard training; and most of the heavier horses, when they were in a "lusty" state. It would be more satisfactory, if they had been photographed at a time when they were all in "hard" condition; but that, obviously, was impossible to get done. The method I shall indicate will, however, give results sufficiently uniform for our purpose. We must also remember that the respective proportions of animals of the same class and of equal merit are not always the same; for a defect in one point may be compensated by increased excellence in another point.

Relations between Height and Length of Body.—We have seen in Chapter I. that the fundamental difference between animals of speed and those of strength is that the former have comparatively long legs, and that the latter have comparatively short ones. We have in the camel a well-marked exception to this rule. The Ship of the

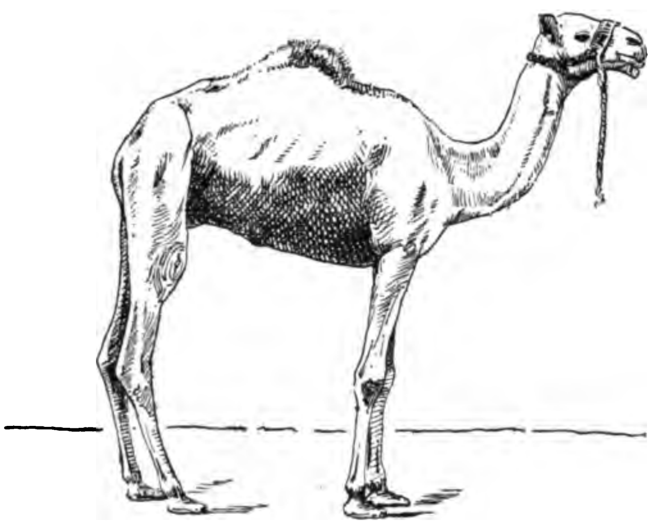

Fig. 273.—Camel.

Desert, as we may see in Fig. 273, has very long legs in comparison to his length of body, and yet he is extremely slow for his size. The cause of his lack of speed is chiefly owing to the weakness of his "rearing muscles" (p. 67), and to the straightness of the column of bones of his fore limbs. Hence, when he tries to go quickly, he is unable to raise his fore-hand to a sufficient height, in order to obtain a well-regulated period of suspension, like that of the horse (Figs. 71, 154, and 189). His gallop, which he attempts only on rare occasions, has so much up-and-down motion in it, that he can continue it but for a very short time. His usual fast pace is a kind of amble which has no period of suspension. The muscles of his limbs, as compared to the weight of his body, are very poorly developed. Many "weedy" horses (p. 368) which have long legs, are deficient in speed from causes similar to those that render the camel slow. The law as to length of limb can be amply verified, other things being equal, in the case of the horse, by the hard logic of statistics. I accordingly give the following table of measurements in inches, taking Ormonde (Frontispiece) and St. Simon (Figs. 16 and 17) as examples of the fleet of foot, and the Shire horse, Cheadle Jumbo, and the Shire mare, Chance (Fig. 274), as illustrations of strength.

	Ormonde.	St. Simon.	Cheadle Jumbo.	Chance.
Height at withers (without shoes)	64½	63¼	67	67
Length of body	61½	59½	76	76
Depth from withers to brisket . .	29	27¼	35½	34
Distance of "girth place" from ground	35½	36¼	31½	33
Length of head	24½	24	29	28

I took the measurements of Ormonde on the 20th July, 1887, when he was a four-year-old; and those of St. Simon in September, 1884, when he was a three-year old. The photographs of Ormonde and St. Simon are particularly valuable, as these animals were probably the two best race-horses that have ever lived, and as their photographs were taken when they were in racing condition. The outlines of Fig. 17 have been taken from a photograph which was too much "fogged" to bear reproduction. The shadows, however, have been added by a very skilful artist, the late Mr. Oswald Brown.

We see from the foregoing table, that some three and four year-old race-horses of the best class are 3 or 4 inches higher at the withers (and at the croup) than they are long in the body; and that the Shire horse, which is the most powerful of all horses, is about 9 inches longer than he is

Photo by] [DIXON & SONS.

Fig. 274.—Mr. A. B. Freeman-Mitford's Shire Mare, Chance.

high. The difference between the two types with respect to their length of leg, as compared to their depth of chest, is equally well marked. The intermediate classes, in this respect, partake, as a rule, of the characteristics of the respective types to which they are most nearly allied. Thus, if we take Ormonde (Frontispiece) as the highest type of the race-horse, we shall find that the distance from the top of his withers to his brisket, if applied down his fore leg, will reach from his brisket only to the bottom of his fetlock. In a high-class Leicestershire hunter (Fig. 275), it will come down to the middle of the pastern; in the heavy-weight hunter, to the coronet; in the Artillery "wheeler" or light cart-horse, to the ground; and in a Cheadle Jumbo, it will be four inches more in length. Hence we may conclude that the term, "short on the leg," is one to denote the possession of strength, rather than of speed. The reckless manner in which it is used with respect to race-horses is as incorrect as it is ridiculous. With age, good feeding and want of exercise, a horse usually lengthens, deepens, and thickens somewhat as regards his height. Mr. W. F. Shaw, F.R.C.V.S., who has charge of the horses belonging to the London Street Tramways Company, tells me that he has frequently observed that comparatively light, well-bred horses, when put to tramway work at about five years of age, thicken and get coarse after a few months, to a far greater extent than if they had been used at fast paces. We all know that labour between the rails is slow; and the feeding (eighteen pounds of corn and twelve pounds of hay) is ample for these not very large animals. We may accept the fact that both muscles and bones more or less accommodate themselves in time to the nature of the work to which they are put; the difference being one of thickness, and not of length. I have often noticed among thorough-breds that, to a certain extent, they became coarse and lost their appearance of blood if kept under rough conditions and used for ordinary hack work.

St. Gatien (p. 25), the celebrated son of The Rover and St. Editha, was a very deep-chested horse, as his depth from his withers to his brisket (just behind the elbow) was an inch more than from his brisket to the bottom of his fetlock. He was thus an inch deeper than Ormonde, who was one and three-quarter inches deeper than St. Simon. St. Gatien was particularly distinguished by his ability to stay a distance.

The fact of foals (Fig. 276) being extremely "long on the leg" accounts for their great speed as compared to their strength. Without this peculiarity of conformation, there is no doubt that the horse, prior to the time at which he became domesticated, would not have survived in the struggle for existence.

Comparative Height at Withers and Croup.—"Comparative length of fore and hind limbs" would be a

Photo by] [M. H. H.

Fig. 275.—Mr. H. T. Barclay's Lord Arthur.

more correct heading for this paragraph than the present one, which has been adopted solely for the sake of convenience. It goes almost without saying that it is much easier to compare the respective heights of a horse at the withers and croup, when he is standing in the ordinary position in which we get him placed for inspection, than to judge of the comparative lengths of his fore and hind legs, clothed as they are with skin and muscle. In adopting the more convenient method of the two, due allowance should be made for the attitude in which the horse places himself.

The conditions under which the limbs play their part in locomotion, are so complex and varied, that rules can be laid down on this subject, only in very general terms. We must also bear in mind that there is a certain limit of height (largely influenced by breed) which a horse should not exceed, and which will be discussed on page 180, *et seq*. The present question may be put as follows: at any given height, is it an advantage for a horse to be higher at the withers than he is over the top of the croup, or *vice versâ*, when he is intended for galloping, jumping, light harness, or heavy draught; and to what extent may such difference, if any, amount to? It is evident that the longer the hind legs, the greater—other things being equal—will be the speed of propulsion. Excess of height at the croup will, however, be accompanied by three serious drawbacks: (1) by putting increased work, during fast paces, on the fore limbs and on the muscles of the back and loins (p. 67) in raising the fore-hand at each stride, it will diminish the animal's staying power; (2) by surcharging the fore legs (p. 53), it will naturally tend to render these limbs more liable to the injurious effects of work than they would be, were the weight more equally distributed between the fore and hind extremities; and (3) by overloading the fore-hand, it will tend to prevent the cross-country horse rising easily at his fences and getting away safely from them on landing. Those speedy animals, the cheetah, the Indian black buck, and the greyhound, are a little longer in the hind limb than they are in front. As a rule, race-horses of the highest class are about the same height at withers and croup. This difference between the racer and the other gallopers may be accounted for by the fact that the proportion of weight which the fore limbs of the race-horse have to carry, is still more increased by the presence of a jockey on his back. Among the fleet of foot, I purposely omitted mentioning the hare, whose fine speed can be maintained, as we might have inferred, only for a short distance on level ground ; though it is particularly hard to catch up a hill, the difficulty of ascending which is directly lessened by the fact of the fore limbs being shorter than the hind ones. Any disadvantage, in progression, arising from undue shortness of fore legs

Photo by] [M. H. H.

Fig. 276.—Foal.

is, more or less, compensated for, in the hare, by great development of the muscles of the loins ("rearing muscles," p. 67). The lynx (Fig. 4), which is very high behind, has an extraordinary turn of speed ; but only for a short distance. Its gallop, like that of other cats, is a series of leaps (p. 142). From practical observations, I do not think that it is an advantage for a race-horse to be higher over the croup than at the withers. With regard to this point, we may study Ormonde (Frontispiece) and Persimmon (Fig. 277). Could a horse be reserved for races up-hill, like on the old Cambridgeshire course, which finished at "the top of the town," increased height at the croup would be an advantage; but such a policy would hardly be practicable. We may conclude from the foregoing remarks, that if a race-horse be higher over the croup than at the withers, he will require, all the more, to have sloping shoulders, oblique pasterns and powerful loins, and to be light in his head, neck and shoulders.

We have now to consider the very practical question—which, no doubt, every man who goes in for pony racing has asked himself—is it an advantage for a pony which has to pass the standard at a certain height, to be considerably higher over the croup than at the withers? The results of my experience make me reply "no" to this query. The statement, which has often been put forward, that a pony which measures, say 14.3 over the croup, and which can pass the standard at fourteen hands, must have a "pull" over others of its own class which are as high at their withers as over their croup, is not borne out in practice. The best racing ponies I have seen, had no great difference between these two measurements—certainly not more than two inches. In this list we have the English ponies Predominant (Fig. 278), Lord Clyde, Maythorne, Mike (Fig. 279), Water-lily (Fig. 337), St. Helena, Selena, and Sylvia; the New Zealanders, Little Wonder and Parekaretu; the Australians, Mayflower, Achievement, Chester, Bob, and Jeannette; the Arabs, Caliph, Little Hercules, Blitz (Fig. 593), and Sweet William; the Barb, Kangaroo; the Indian country-breds, Ruby, Bonnie Doo, and Daphne; and the South African, Coachman. Skittles, which belonged to Captain Mowbray of the Black Watch, and which was a very good fourteen hand pony, showed, I think, the maximum of comparative height behind.

Her excess of height at the croup (about 2 inches) was compensated for by the possession of remarkably long and sloping shoulders. The large majority of racing ponies I have known which were much lower at the withers than at the croup, stood work badly, owing to their fore legs being unusually liable to become infirm. We may fully accept the statement that instability of equilibrium (p. 69), which is increased according as the weight on the fore legs exceeds that on the hind ones,

Photo by] [W. A. ROUCH, STRAND.

Fig. 277.—His Majesty's Persimmon.

should be obtained, in the galloper, more by the body being short and the legs and neck long, than by the difference of height between the withers and the croup. I cannot too strongly direct the attention of my readers to the necessity of the hunter (p. 378) being "light in front," and consequently, being higher at the withers than over the croup.

The lower a horse is in front, other things being equal, the rougher will be his paces; and consequently an animal of this kind of conformation will not, as a rule, make a pleasant hack. I had a good proof of this in the horse which is shown in Fig. 280, and which I owned when I lived in India. He was a fine weight-carrier, fast trotter, and a grand galloper up a hill; but he was very rough when cantering or galloping on level ground, and especially down an incline. Owing to this objection he was put to harness, where he did much better than in saddle, because the roughness of his gait was no detriment to his utility between the shafts.

The position of the rider of a saddle horse increases the instability of the equilibrium of the animal ; but that of a trap and its occupant diminishes it. Hence, horses will, as a rule, trot faster under saddle than in harness. Also, we find that in match trotting, the tendency is to get the weight of the driver as far forward as possible. In the olden days of high wheels and the "long-hitch" sulky, the American match trotter was lower at the withers, as compared to his height at the croup, than the race-horse; but improvements in sulkies have greatly lessened or entirely removed this difference. We must here bear in mind that, with a modern sulky (Fig. 60), the body of the driver offers far less resistance to the air than that of a jockey. When the height at the withers is less than at the croup, the proportion of weight on the fore-hand is increased by conformation, and not necessarily by undue development of the muscles of the shoulders and neck.

The heavy cart-horse, viewed from a draught point of view, ought to be higher in front than behind (p. 78).

Points in Common.—We may advance a step further in our search after the true principles of horse conformation; for if we compare the proportions of the body of the racer with those of the heavy draught animal, we shall find that they are essentially the same, and that the only real difference which exists between these two classes, is in the relative length and thickness of their legs. Were those of the speedy Ormonde (Frontispiece), cut down nine or ten inches and proportionately thickened, and were he swelled out by "bulky" food, he would pass fairly well as a cart-horse! The statement just made concerning the comparative proportions of the two

Photo by] [R. HOTZ, SIMLA.

Fig. 278.—H.H. The Maharaja of Kooch Behar's Racing Pony, Predominant, by Balfe, out of Dominante.

extreme types of horses, may not appear so outrageous as it might do at first glance, if we consider that the difference of work between them is one of limbs and not of body. The galloper needs the highest possible development of speed with a sufficiency of strength; the cart-horse, a maximum of strength with a very moderate amount of speed; both the strength and speed being derived from the muscles of the limbs. The two classes, however, are in their work equally dependent on the organs (those of breathing, circulation, digestion, secretion, etc.) which are contained in the body. The lungs of a draught animal, when facing a steep hill with a heavy load behind him, have to be in as good order as those of a racer which is finishing in front of the Grand Stand at Epsom or Newmarket. His stomach, bowels, liver, spleen, kidneys, etc., will also require to be as healthy as those of the other. Hence we need not expect to find, nor shall we meet with, any material difference in the proportions of the respective bodies of these two animals. If we take from the table given on page 170, the depths, from withers to brisket, of the four representative horses, and divide them respectively into the lengths of these animals, we shall find the ratio for Ormonde, St. Simon and Cheadle Jumbo to be 1 to 2.1, and for Chance, 1 to 2.2. Also, the proportion between the depth of the body at the lowest point of the back, and the length of the body, is about the same in all classes of horses, namely, 1 to 2½ (nearly). This is sufficient to prove the close similarity of the proportions of the body in racers and heavy cart-horses, and, *à fortiori*, in those of the intermediate classes, such as hunters, troopers, and light harness horses.

It may be objected to the foregoing remarks that, in the heavy draught animal, the shoulders are thicker, and the breast broader in proportion to the length of the body, than in the case of the galloper. This difference, however, is due, not to the shape of the body, but to the size of muscles which are attached to the body (p. 244), and which assist in movement. Consequently, they partake of the character of the muscles of the legs.

Limit of Height.—In all species of animals there appears to be a limit of height which the respective members cannot, as a rule, exceed, and at the same time retain strength, activity and symmetry of form. We see this law well exemplified in dogs, which can rarely sur-pass, say, thirty-four inches in height, without becoming weak in the loins and clumsy in their movements. For cart-horses, this limit may be put at, say, seventeen hands two inches; and for race-horses at, say, sixteen hands three inches. Besides this maximum, there is a certain height which it is no benefit for a horse, from a useful point of view, to exceed. Although, to employ an old saying, "a good big one will beat a good little one;"

Photo by] [M. H. H.

Fig. 279.—Colonel Simpson's English Racing Pony, Mike.

it is no advantage for a racer, chaser, hunter, hack or light trapper to be more than fifteen hands three inches, or a heavy cart-horse to be higher than sixteen hands three inches. It is an interesting fact that this standard of useful height varies considerably in different breeds. It can be put approximately as follows:—European, North American, Australian, and New Zealand thoroughbred and half-bred horses, fifteen hands three inches;

ordinary South African horses, fifteen hands; Arabs, fourteen hands two inches; East Indians (country bred, without admixture of English blood) and Basuto ponies, fourteen hands; Mongolian, Yarkundi, Spiti and Bhootiah ponies, thirteen hands two inches; Baluchi, Herati and Cabuli horses, fourteen hands two inches; Burma and Deli (Sumatra) ponies, thirteen hands; Manipuri ponies, twelve hands. On Indian race-courses it has been proved, times out of number, that an Arab of fourteen hands two inches is as good as any other Son of the Desert, no matter how much he may exceed that height. In fact, there have not been many Arabs which have gone to India, that were better than the gallant little Chieftain, who was only fourteen hands high, and who was the best of his time. The records of the Shanghai and Hongkong races prove that a good Mongolian of thirteen hands two inches, like Teen Kwang (Fig. 281), who was the Eclipse of the Celestial Empire, can hold his own with any of his class, even at level weights. In China an allowance of only three pounds for an inch in height is given, and yet the best ones are found at about thirteen hands two inches. In India, on the contrary, an allowance of twelve pounds an inch is given; yet, with very rare exceptions, a thirteen hands one inch or a thirteen hands two inch English, Australian, Arab or "country-bred" has no chance with a fourteen-hander of its own class. These striking differences in the standard of useful heights are no doubt chiefly due to the effects of climate and soil (p. 396 *et seq.*).

Careful selection in breeding, good feeding, and healthy conditions of life have a great influence in tending to increase the size, not only of individuals, but also of breeds, in which case the standard of useful height will naturally become raised. Thus, the average English horse is, at the present day, probably six inches taller than he was 200 years ago. From my own observation, I am inclined to think that horses in England have increased about two inches in height during the last fifty years. We should remember that when we refer to certain breeds of ponies, we allude to horses that have for generations been kept small by privation, inclemency of climate, or other influences which have retarded their growth. Were they placed under conditions favourable to their development, their descendants would soon become full-sized horses, even in the case of Shetland

Photo by] [M. H. H.

Fig. 280.—Australian Horse, low at the Withers.

(Fig. 282), Hebridean (Fig. 283) or Corean ponies. Selection, as in the case of toy-terriers, would of itself, if carried out strictly, enable us to maintain a breed of dwarf horses; but when with small size we also require physical excellence, this application of selection would certainly prove too costly for practical requirements. Hence, in temperate climates like those of Australasia, and the low-lying lands of England, horse-breeders very seldom undertake the task of maintaining a breed of ponies which are

well fed and well cared for. Extremely good polo ponies, like Dynamite (Fig. 284), and racing ponies, like Predominant (Fig. 278), are more or less flukes in breeding. At the same time, we must not ignore the following three facts in this connection :—(1) That the respective offspring of certain sires and certain mares are abnormally small; (2) first foals are often smaller than subsequent ones; and (3) the produce of very old sires are frequently lacking in height.

Thickness of Limb.—Continuing the argument begun in Chapter I., we find that the muscles of the limbs of gallopers are comparatively long and slender. Hence, the bones, being dependent on the muscles for their shape, must partake of the same character. Also, it is advantageous that they should be slight; because, were the bones of the legs of the galloper massive, the friction in the working of their joints would be proportionately increased, with consequent loss of speed, which would be of little importance in a heavy draught animal, in which the opposite kind of conformation should be sought for.

Length of Neck.—As the muscles which draw the fore leg forward (namely, those of the neck) are muscles of locomotion, they should be proportionate in length to those of the fore limb. Hence, if a horse has long fore legs, like the race-horse, he ought to have a long neck; and *vice versâ*.

Length of Head.—As the respective functions of the head and body are not affected by the nature of the work (as regards speed and strength); the length of the head, as a rule, is proportionate to that of the body (trunk); but it bears no fixed ratio to the length of the limbs, which varies according to the kind of work to which the particular horse is best suited. Thus, we find that although the length of the head has nearly the same proportion (about 1 to 2½) to the length of the body in both the racer

Fig. 281.—China Pony, Teen Kwang.

Photo by] [C. TADMAN, STANSTED.

82.— Gilbey's Shire Horse, Norman Conqueror, and
nd Pony, Good Friday.

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Fig. 282.—Sir Walter Gilbey's Shire Horse, Norman Conqueror, and Shetland Pony, Good Friday.

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Fig. 281.—China Pony, Teen Kwang.

Photo by] [C. TADMAN, STANSTED.

Fig. 282.—Sir Walter Gilbey's Shire Horse, Norman Conqueror, and Shetland Pony, Good Friday.

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Photo by] [C. Tadman, Stansted.

Fig. 282.—Sir Walter Gilbey's Shire Horse, Norman Conqueror, and Shetland Pony, Good Friday.

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Fig. 281.—China Pony, Teen Kwang.

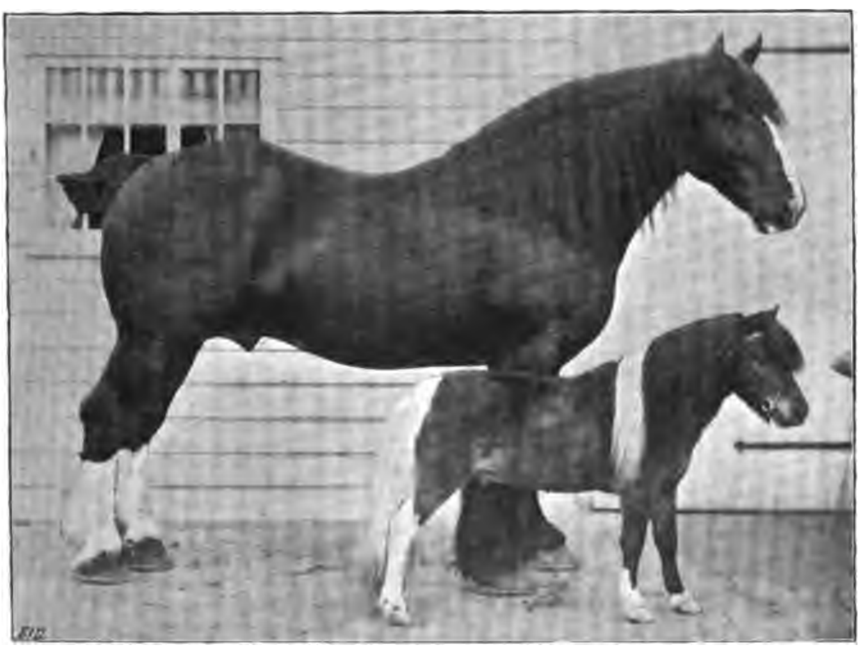

Photo by] [C. TADMAN, STANSTED.

Fig. 282.—Sir Walter Gilbey's Shire Horse, Norman Conqueror, and Shetland Pony, Good Friday.

and cart-horse (p. 170), the comparison does not hold good with regard to the height, which is naturally influenced by the length of the fore legs. In calculating the proportion between the length of head and length of body, in the case of Cheadle Jumbo and Chance (p. 170), we must bear in mind that these animals were in obese show condition at the time the measurements were taken.

Comparative Weight of Body.—The body of all saddle horses should be as light as is compatible with the due performance of their work; for any extra weight will be carried at the expense of the soundness of their legs. It is different with the harness horse, which has, comparatively, no weight on his back. The heavy cart-horse requires a deep, massive body for the attachment of his powerful muscles, and, also, to give him the necessary weight to throw into the collar. This subject has been discussed on pages 76 and 77.

Comparative Length of the Bones of the Limbs.—If we "pick up" in succession the fore feet of a number of differently shaped horses, and bend the limbs at the knees as far as they will "go," we shall find that in almost all cases, the heel will touch the elbow (Fig. 285) at about the same place.

This statement is supported by the following measurements which Professor Ewart took of the bones of the fore legs of Hermit, Eclipse, and a Shetland pony.

	Radius (Bone of the fore-arm).	Cannon bone.	Phalanges (Bones of the pastern and foot).
Hermit (15¾ hands)......	37.5 cm.	25.5	19.5
Eclipse (15¾ hands)......	37.6 ,,	25.8	19
Shetland pony (9½ hands)	25 ,,	17	12.8

The above measurements are in centimetres, each of which is equal to .3937 inch.

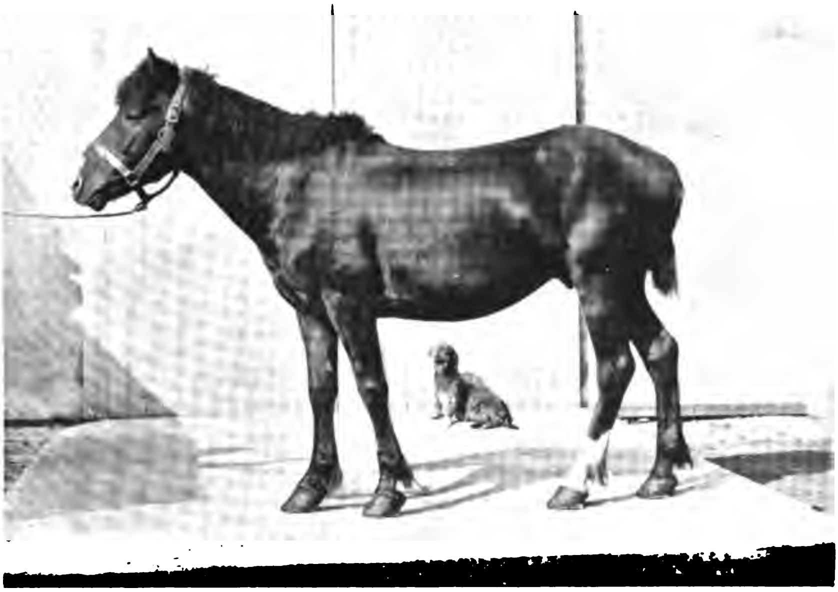

Photo by] [G. A. EWART.

Fig. 283.—Barra (Hebridean) Pony.

Photo by] [M. H. H.

Fig. 284.—Mr. J. E. Peat's English Polo Pony Mare, Dynamite.

If, to facilitate comparison, we take the radius of Eclipse and that of the Shetland pony as equal in length to that of Hermit, we shall have the following proportions:

	Radius.	Cannon bone.	Phalanges.	Cannon bone and Phalanges.
Hermit	37.5	25.5	19.5	45
Eclipse	37.5	25.72	18.95	44.68
Shetland pony	37.5	25.5	19.2	44.7

We thus find that there is very little difference between the respective proportions of the radius, cannon bone, and phalanges of these animals, and that the fore legs of the Shetland pony, in this respect, more closely resemble those of Hermit, than do those of Eclipse; the cannon bone being comparatively shorter in the "Sheltie" and in the Derby winner, than in the famous old-time race-horse.

A comparatively short cannon bone is greatly admired in hunters by experienced horsemen, but it is not a "point" which is usually noticed in race-horses. Although I have not tested this relative shortness of the cannon bone by actual measurements, I am strongly inclined to accept its existence, on account of its wide recognition and because variation plays a large part in all animal structures, as we may see by referring to Bateson's *Materials for the Study of Variation*. Bearing in mind that the proportion between the length of the fore-arm and that of the bones below the knee is fairly constant, we must admit that if the cannon bone is shorter than usual, as compared to its fore-arm, the bones below the fetlock will be comparatively long. Lecoq remarks: "The length of the fore-arm varies inversely as that of the cannon-bone." This principle may be extended somewhat further, by stating the following inverse proportions :—Shoulder-blade, long; humerus (from point of shoulder to elbow joint), short; fore-arm, long; cannon-bone, short; pastern, long. In other words, a long shoulder-blade is accompanied by a long fore-arm and long pastern, and by a short humerus and a short cannon-bone. The converse of this holds equally good. Taking the shoulder-blade as the base to start from, we may infer that the difference between these alternate proportions should be best marked in animals, like the hunter or steeplechaser, which specially require

Photo by] [M. H. H.

Fig. 285.—Fore Foot drawn up, so as to touch the Elbow.

to have this bone of considerable length (p. 274). It may be objected that the greyhound (Fig. 8), which is possessed of extraordinary speed and marvellous jumping power, has, comparatively speaking, a short shoulder-blade and long humerus. Although the length of the latter, which is detached from the body, gives him great forward "reach;" the shortness of the former makes him too bad a weight-carrier (p. 274) for him to be accepted as a model for our purpose. We are probably justified in assuming that a similar series of inverse proportions should exist in the hind limb. Thus : pelvis, long ; thigh, short ;

heads are far more common among "the five furlong division," than among genuine stayers. Again, the head should be of sufficient size to afford a broad surface for the attachment of the muscles of mastication, for those which extend, flex, rotate and move the head from one side to the other, and for muscles which draw the fore limbs forward, and which are, consequently, important agents of movement. The connection between the size of the head and the amount of intelligence possessed by an animal is, as in man, too ill-defined to admit of any practical deductions being made from it. As the usefulness of a horse is generally limited by the amount of work his legs will stand, the possession of a heavy head by an animal which is "light of bone" in his extremities, is a serious defect; for it shows that his frame is wanting in symmetry, and also tends to indicate that the bones of his body, and, probably, the muscles and other tissues, are too heavy for his legs. If, however, he shows great substance and good quality of bone, tendon and ligament, we might very well "put up" with some "plainness" about his head. Any useless weight of that part, acting at the end of the lever formed by the neck, will naturally be objectionable. Agreeably to the facts mentioned on pages 184 and 186, we may judge the length of the head by that of the body, the usual proportion being about 1 to 2½. Or we may compare the length of the head with the depth of the body at the lowest point of the back. In a well-shaped horse which is not in gross condition, these two measurements are very nearly equal; although the head, from its isolated position, looks much less long, at first glance, than the body is deep. Besides, the fact of the body being round, while the side of the horse's head, as seen in profile, is flat, will cause the depth of the former to appear to measure more than the length of the latter. We may prove the approximate correctness of the ratio of 1 to 2½, by reference to the table given on p. 170. From it we see that in Ormonde the proportion is 1 to 2.5; in St. Simon, 1 to 2.48; in Cheadle Jumbo, 1 to 2.6; and in Chance, 1 to 2.7. Here, possibly to our surprise, we perceive that the cart-horses have comparatively smaller heads than the racers—a difference which, no doubt, is due to their grosser "condition"; as the fat on their chests and quarters must add slightly to their length of body. Bourgelat, followed by all, or nearly all, the French writers on equine conformation, adopted the length of a horse's head as a measurement of the animal's height, in the proportion of 1 to 2½. This eminent Frenchman based his calculations on a type of horse (such as the ordinary saddle nag) which was about as high at the withers as it was long in the body, and did not take into consideration the great differences between the respective heights and lengths of animals of various classes, ranging from the racer to the Shire horse.

The fact that the size of the head of a horse is proportionate to his length of body, and not to his height at the withers, accounts for cart-horses appearing to have a comparatively larger head than thorough-breds.

Leanness of Head.—In the lighter classes of horses, the head should present a general appearance of "leanness," that is to say, the skin which covers it should be fine; its bony prominences sharply marked; and the muscles, blood-vessels, and nerves which are immediately under the skin, more or less clearly defined.

The absence, thus indicated, of an excess of loose underlying tissue will suggest the possession of strength of muscle and bone (p. 32). When the head is large and "fleshy," we may generally assume that the animal is "soft" and wanting in "blood." The presence on the head of well-developed muscles, of which those of mastication are the most powerful, will naturally suggest to the observer that the horse has a good constitution. As pointed out by Goubaux and Barrier, we must not mistake for "leanness," an emaciated or wasted appearance of the muscles, due to old age or debility.

The Bombay Arab dealers (such as that fine judge, Ali bin Abdullah, and that prince of Bedouins, the late Shaikh Esa bin Curtas) regard thinness of the lower jaw at its angles as a sure sign of pure Desert blood.

Profile of Face.—The line of the forehead and nose, when viewed in profile, will, as a rule, be straight (Fig. 286), concave (Fig. 287) or convex (Fig. 288). The first two forms of contour are more or less characteristic of the thorough-bred and Arab. Although many horses of aristocratic English blood have Roman noses, especially those bred in the Colonies (Fig. 288), I have never seen a high caste Arab (Figs. 289, 290 and 291) have such a conformation. The true concave face is obtained, not by a prominent forehead, as in Fig. 292; but by a dip in the nose between the eyes and nostrils (Fig. 287). Ormonde's face (Frontispiece) tends to concavity. A Roman nose (Fig. 293) might be objected to on account of its supposed liability to render the air passages of the head curved, instead of straight, in which case there might be some slight interference with the ready ingress and egress of respired air. I have, however, never met with a case in which a Roman nose was the cause of impaired breathing power; although I have known a horse become a roarer from alteration in the shape of the nasal cavities, from a disease of the bones called *osteo porosis* ("big head"). Many heavy cart-horses have a Roman nose, which is a characteristic feature of the Austrian Imperial Kladrub carriage-horse (Fig. 294).

Colonel John Anderson, late Inspecting Veterinary Surgeon, Bombay Army (than whom no better judge of a horse exists), remarked to me many years ago, that a prominent forehead (Fig. 292), or a rise between the eyes, is an indication of a bad, or at least of a wayward, temper in a horse, which is a theory I have seen verified in many instances. The original of Fig. 292 was a rascal of the deepest dye. Tristan (Fig. 295) had this fatal bump between his eyes, and he was a "thief," as well as a bit of a "savage." His name will recall to many old race-goers the memorable struggle for the Cambridgeshire of 1881, when, ridden by poor George Fordham, he finished third to Foxhall and Lucy Glitters. It is but just to the chestnut son of Hermit and Thrift to say that

Photo by] [DIXON & SONS.

Fig. 286.—Straight Line of Face.

his trainer, Mr. Tom Jennings, told me that Tristan's temper had been spoiled by bad usage when he was a yearling.

Front View of Face.—Good width of forehead between the eyes (Fig. 296) indicates, as a rule, free breathing power and strong muscles of mastication; for the bones of that part (*frontal bones*) form a portion of the roof of the chambers through which air passes on its way to the lungs, and gives attachment to a powerful muscle which aids in closing the jaws, and which is fixed in the large depression that is just above the eyes. Good width between the eyes is generally regarded as a sign of intelligence and of a generous disposition ; and it may indicate large capacity of brain, by reason of the frontal bone forming a portion of the covering of that organ. I shall refer, under the next heading, to the subject of the desirability, or otherwise, of a large brain in the horse.

As seen from the front, the bones at each side of the head, from the outside corner of the eyes to the hollow above the eyes, should run nearly parallel to the long axis of the head, and should then narrow inwards, in saddle horses and light harness horses. This desirable shape is well shown in Fig. 297. If the reader will compare this photograph with Fig. 298 he will see my meaning ; for in the latter, the line from the outside corner of the eye to the base of the ear is nearly straight. This peculiarity and a certain fulness of nose (which is very different to the fine modelling of the nose in Fig. 297) gives a coffin shape (Fig. 299) to the head in Fig. 298, which is slightly fore-shortened, and consequently does not appear as narrow as it ought to be. I am of course aware that the stable term, "coffin-shaped," as applied to a horse's head, has reference to its appearance in profile, and not to its front view.

Experience tells us that the forehead should be prominent immediately below the brow-band, and should be marked on each side by a well-developed lump of muscle which is shown fairly well in Fig. 297. I am inclined to think that this conformation is usually accompanied by the possession of pluck and "cleverness" ; but can give no reason. Its good or poor development is, I regret to say, as difficult to clearly explain in words as it is to show in a photograph ; although its recognition in actual practice is an easy matter.

It is regarded as a beauty for the eyes to be "set high

Photo by] [M. H. H.

Fig. 287.—Concave Line of Face of Thorough-bred.

Photo by] [THE GRESHAM STUDIO, ADELAIDE, SOUTH AUSTRALIA.

Fig. 288.—Mr. W. Clark's The Victory, winner of the Adelaide St. Leger, etc.

up" in the head. As far as I can see, their position varies but little in the horse. In the mountain zebra (Fig. 310) they are set rather low down.

The bones on the sides of the nose are prominent in youth, but gradually "fall in" with age, on account of the roots of the back teeth, which are lodged in them, descending lower and lower as the animal grows older. This change in the form of the nose will serve to indicate, to some extent, the age of the horse.

Size of Brain.—Without entering into any physiological argument, we may assume that, as a rule, size of brain is an indication of brain power. According to the classic idea entertained by writers on equine conformation, a large development of brain is a desirable "point" in the horse. Thus we read in *Achat du Cheval*, by Gayot, that: "The more voluminous is the brain, the larger is the spinal cord, proportionate to the size of which are the nerves that issue from it. It is thus that a large forehead, denoting a high degree of intelligence, is the index of a good nervous system—that is to say, of high mental and physical qualities." As regards this, I would suggest a doubt respecting the connection claimed between "high mental and physical qualities." It did not exist among the ancient gladiators, nor does it in our modern prize-fighters and pedestrians. Although the bull-dog and greyhound are respectively stronger and faster for their size than the poodle and collie, they are certainly not more intelligent. A long acquaintance with horses —especially that acquired during my horse-breaking tours—convinces me that a comparatively high degree of mental (*i.e.* reasoning) power is not desirable in a horse; because it is apt to make him impatient of control by man. A jibber in harness, or a refuser in the hunting field, when the vice has not been induced by pain or infirmity, such as galled shoulders or weak hocks, usually "balks" because "he knows too much," or at least

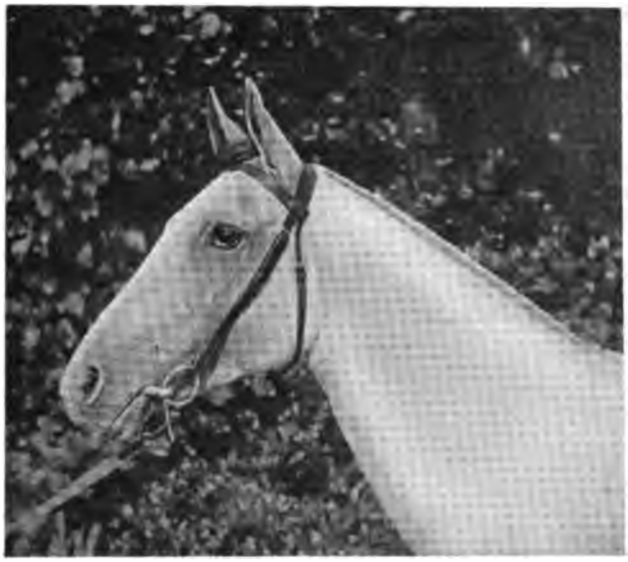

Photo by] [DIXON & SONS.

Fig. 289.—Head of the Arab Horse, Magic.

Photo by] [M. H. H.

Fig. 290.—Head of High Caste Arab.

he knows more than the animal that will pull at the traces or follow the hounds till he drops. So far from a horse taking delight, as he is supposed by novelists to do, in obeying the wishes of man, he very seldom yields to his would-be master without a struggle. If this takes place in the hoped-for manner, when the horse is quite young, the victory on the part of the man is generally easy, and a few repetitions of it quickly confirm the habit of obedience. If, however, the attempted subjugation be delayed till the animal is "aged"—when he will be able to think for himself without the promptings and influence of man—it will be found that his breaking will be ten, if not a hundred, times more difficult than if it had been undertaken in his early youth. This theory of the undesirability of a horse knowing too much, which I have applied to refractory animals, appears to hold equally good in greyhounds that run "cunning." In these remarks on the intelligence of horses, it must be clearly understood that I refer to reasoning power and not to power of memory, which is independent of the capacity to draw conclusions from given premises. It is evident, without the necessity of writing a treatise on the subject, that the useful (to man) intelligence of the horse lies in his power of memory and in the quickness with which his muscles act in response to the impressions received by his senses. In other words, his useful intelligence depends on the high development of his instinct, and not of his reason. We demand of the horse ready obedience; but not obedience matured by reflection, like what the shepherd would expect his dog to display when getting his flock home on a stormy night, or when driving them through a crowded thoroughfare. We do not ask him to take the initiative from the deep affection which he does not bestow on us, nor to reason out problems; we only want him to remember that if he does certain things, we shall "make much of him"; that if he does other things, we shall punish him.

Photo by] [M. H. H.
Fig. 291.—Head of High Caste Arab.

Photo by] [M. H. H.
Fig. 292.—Prominent Forehead.

We know that reflex action, prompted by stimuli from outside the body, acts best when it has but little connection with the brain. In fact, the smaller the comparative size of the brain, the quicker and more accurately are instinctive movements performed. Thus we see animals with, comparatively, a very small brain, or with none at all, get out of danger, or seize their prey, with an amount of speed and precision which it would be hopeless for any man to attempt to rival; simply because the action of his instinct is impeded by the influence of a large brain. We find this demonstrated in ourselves, in the case of movements which, like those in fencing, boxing and dancing, for instance, can be executed only slowly and clumsily at first, when they need the exercise of thought, become capable of being performed with the speed and correctness of a machine, as soon as practice has made them almost automatic.

Sir James Crichton Browne has shown that wild ducks are far more intelligent than tame ones, which, since their domestication, are "sinking into imbecility." In comparing twenty wild ducks with twenty tame ones, he found that in the former, the proportion between the brain weight and the body weight was 1 to 338.318; and in the latter, 1 to 179.669. Hence the relative weight of the brain of wild ducks is nearly twice as great as that of tame ones. This is evidently a case of cessation of selection for many hundreds of years, and is similar to that of the domestic horse, which is far less intelligent than his wild relations (Chapter XXXIII.).

The prominent forehead (Fig. 292), to which I have alluded on p. 194, indicates a large size of the intellectual portion (*cerebrum*, p. 48) of the brain, which, on the forehead is covered by only a thin plate of bone. Without wishing to import any of the jargon of phrenology into a discussion on this subject, I may hazard the suggestion that the portion of the brain which is consecrated to the functions of memory and perceptive power,

Photo by] [M. H. H.

Fig. 293.—Roman Nose.

Fig. 294.—The Emperor of Austria's Black Kladrub Stallion, Sacramuso (17.3).

lies underneath the upper part of the forehead, where prominence and convexity of the part is a marked beauty (p. 196).

For the foregoing reasons, we should not look upon the possession of a large brain as a desirable "point" in a horse. Hence, apart from the practical experience I have had, I do not like, as I have said, a bulging-out con-

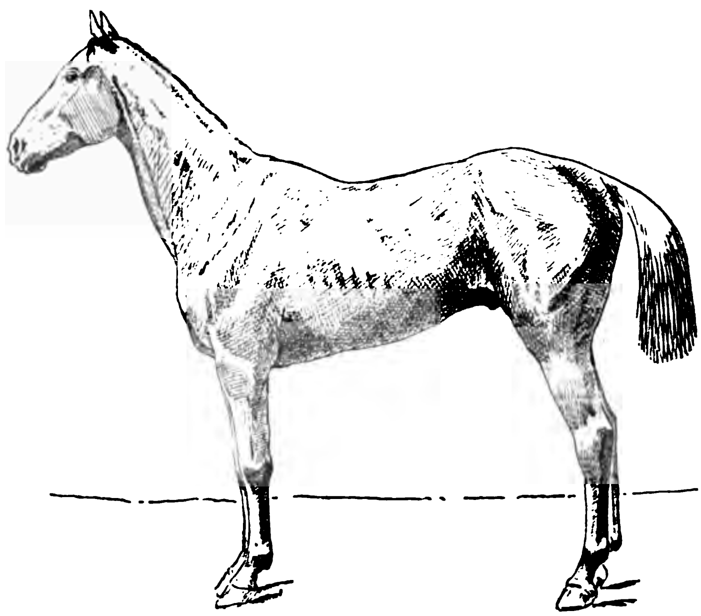

Fig. 295.—Mr. Lefèvre's Tristan.
(*Drawn from a photograph.*)

dition of the lower part of the forehead, nor a long distance between the eyes and the top of the head, both of which peculiarities of conformation point to large brain capacity.

Top of the Head.—The bone (the *occipital crest*) at the top of the head should be prominent and well developed, as it affords attachment for the powerful suspensory ligament of the head and neck (p. 39), and for several important muscles.

Photo by] [M. H. H.
Fig. 296.—Broad Forehead.

Photo by] [M. H. H.
Fig. 297.—Head of well-bred Horse.

Photo by] [M. H. H.
Fig. 298.—Head of under-bred Horse.

Ears.—The organs of hearing, on each side of the head, are divided into the external ear; the middle ear (*tympanum*); and the internal ear (*labyrinth*). "The external and middle ears are conducting; the internal ear is conducting and receptive. In the external ear the vibrations travel through air; in the middle ear through solid structures—membranes and bones; and in the internal ear through fluid" (*Kirkes*). The vibra-

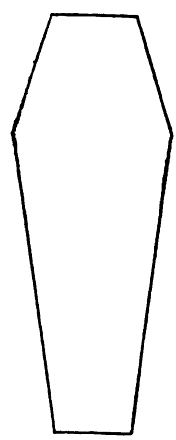

Fig. 299.—Coffin Shape of Head.

tions of sound are transmitted far more readily through solid structures than through air, as we may easily prove by applying our ear to the end of a long plank of wood, and getting another person to scratch lightly with the nail of a finger or other hard object on the other end, in which case we shall hear the sound of the scratching much more plainly than if it were transmitted through the air. We have a similar case by applying our ear to a road, in order to hear the foot-falls of horses which are moving on that road, at a long distance from us. Moles have no external ears, because they use their organs of hearing chiefly for finding the position of neighbouring earth-worms (their natural food), which they do by applying their ears to the sides of their burrows, and listening for the sound of the worms. As the external ear of an animal is less solid than the middle ear, the presence of external ears in moles would diminish their ability to hear sounds transmitted through the soil which they inhabit. The more the external ear of an animal approaches an ear-trumpet, in its large size and funnel-shape, the better will it convey sounds that are trans-

Photo by] [M. H. H.

Fig. 300.—High Occipital Crest.

mitted through the atmosphere. Consequently we find comparatively large and funnel-shaped external ears in animals which, like wild asses, zebras, deer and antelope, require well-developed power of hearing, in the struggle for existence. In the following remarks, the term "ears" will, for shortness' sake, be used only with reference to the external ears. In the horse tribe, the largest ears are possessed by the Mountain Zebra (Fig. 310) and Grévy's Zebra (Fig. 301); the former being an inhabitant of mountainous districts; the latter, of more or less high plateaux.

The ability to find out the direction from which distant sounds come, is largely dependent on the power of rotating the ears to the front, externally, and to the rear. As the higher animals have an ear on each side of the head, there is no need for them to be able to rotate their ears inwards. During the course of evolution, mankind has almost entirely lost the power of rotating the ears, and consequently we are not able to tell the direction of distant sounds with anything like the same accuracy as horses, which have great ear-play. As flight (running away) is the horse's chief natural means of self-protection, he has great ability in turning his ears to the rear, and also in looking to the rear, without altering the forward position of his head. In a pitched battle with carnivorous enemies, wild horses employ their eyes and ears, as a rule, in a backward direction, while using their hind feet as weapons of assault. And even when making a forward rush at an enemy, they almost always "put back" their ears. The fact of a horse looking backwards is at once made manifest by his "showing the white of his eyes." These actions of ears and eyes are so closely connected, in the horse, with fear and anger, that he often performs them, without any direct incentive, when influenced by these feelings. Hence all experienced horsemen regard an unprovoked putting-back of the ears and showing the white of the eyes, as a reliable warning to "look out."

In common, probably, with most observers, I have remarked that animals which move their ears in a quick, decisive manner, evidently with the same intent as they use their eyes to see what kind of ground they are going over, are, generally, of the "clever" sort which do not know how "to put a foot wrong," and have always a "spare leg." Their method of employing their ears is quite different to the restless, "listening" (if I may use some horses "prick their ears" more frequently than others; but, for all that, such carriage of the ears can be regarded as but a temporary lighting-up of the face, and not as a permanent beauty. If a horse habitually carries his ears more or less directed behind him, we might suspect him to be wanting in courage and good temper. This is by no means an invariable rule, for I have met some notable exceptions.

Richard remarks that deaf horses carry their ears

Photo by] [M. H. H.

Fig. 302.—Ends of the Ears Turned In.

Photo by] [M. H. H.

Fig. 303.—Usual Position of the Ears when Pricked Forward.

steadily pointed in the direction they are looking, without side "play." Such animals are generally docile and attentive to the indications received from rein and leg.

A horse is said to have lop ears (Fig. 304) when they are usually carried in a loose and somewhat pendulous manner, and they therefore lack the frequent forward, backward and lateral play of those of the ordinary horse.

Although increased size naturally directs attention to this peculiarity; lop ears are not necessarily large ears. A lop-eared horse is quite as capable of pricking his ears forward (Fig. 305) as any other horse; but, having done so, he generally allows them to fall back into their accustomed pendulous position. Lop-eared horses are generally supposed to be more placid in disposition, if not more sluggish, than their fellows.

The forelock is the front continuation of the mane. It grows between the ears, and for a short distance down the forehead. When allowed to maintain its natural length (Fig. 306), it is a very useful means of protection for a horse's eyes, against the attacks of flies, and against the rays of the sun, as we may see by the relief, especially during hot weather, which eye-fringes give horses that have been more or less deprived of their forelocks. In fact these natural eye-fringes act better than artificial ones. The great mobility of its hairs prevents it from being an obstruction to the animal's line of sight.

Eyes.—The eye should be clear and free from tears, the pupil black, and the eyelids thin and comparatively free from wrinkles. A small eye (Fig. 307) in the horse is called a "pig-eye," and is generally considered to denote a disposition that is either sulky or wanting in courage. In this photograph, the straight shoulder, ewe neck, Roman nose and pig-eye point to the plebeian origin of the animal whose portrait it is. The prominent "buck-eye" is generally regarded as an unfailing sign of short sight, which is, however, a very rare defect in horses. Horses which show a good deal of white in their eyes, as the term is, are usually suspected of being vicious; and kickers, as a rule, uncover a portion of the white of the eye (on the side to which the head is turned) when they look back ready to "let fly." This suspicion is naturally heightened, if, at the same time that the danger signal in the eye is

Photo by] [M. H. H.

Fig. 304.—Lop-eared thorough-bred Mare.

Photo by] [M. H. H.

Fig. 305.—Mare in Fig. 304 with ears pricked forward.

displayed, the ears are pressed back close on the neck, the front teeth are exposed by the drawing back of the lips, and a hind foot is kept raised off the ground. I have, however, known horses of most placid temper whose eyes showed a great deal of white all round the *iris* (the coloured portion of the eye), on account of the iris being abnormally small. Under ordinary conditions, the human eye always exhibits a good deal of white, but the horse's eye, as a rule, does not do so, except when its glance is directed to the rear or inwards. Some game, honest horses (like St. Gatien, for instance) show, without looking in a backward direction, a certain amount of white of the eye, which, when it is of a constant reddish tinge, is thought by some to indicate hardiness of constitution and staying power.

On page 208, I have alluded to the tendency which horses have to show the white of their eyes, when under the influence of fear or anger.

Hollows above the Eyes.—The existence of deep hollows above the eyes is objectionable, for it denotes that the animal is old and more or less worn out, or that either its sire or dam was well advanced in years when it was bred, and, consequently, that it is somewhat wanting in vigour.

Nostrils.—The nostrils should be thin, flexible and of ample capacity, so as to suggest the possession of large air-passages. During rest, they should be more or less closed. If they are kept constantly dilated when the breathing ought to be tranquil, we may infer that the animal has something wrong with his "wind."

Lips.—The lips should be lean and comparatively thin; should possess considerable power of movement; and, as a rule, should be kept closed, for the sake of appearance. We may generally consider that a pendant condition of

Fig. 306.—Mare with Forelock, Mane and Tail of Natural Length.

Photo by] [M. H. H.

Fig. 307.—Roman Nose, Small Eye, Ewe Neck, and Upright Shoulders.

the lower lip indicates want of vigour; for it is much more frequently observed among old horses than among young ones. Richard considers that it is often inherited. "We have," says he, "ridden horses full of energy, which had a pendant lower lip. Delphine, formerly a brood mare at the stud at Pin, daughter of Massoud and of a Selim mare, dam of Eylau, had a drooping lower lip, and all her foals took after her in this respect. She, however, possessed energy and blood which have left their mark." Some horses have great length of upper lip, which undoubtedly looks ugly. Both this conformation and the possession of a thick tuft of hair or moustache on the upper lip, are indicative of coarse blood.

Lower Jaw.—The branches of the lower jaw should be broad, as viewed from the side, and should be wide apart at their angles, so as to give plenty of room for the tube (the *larynx*) which lies between them, and which opens into the wind-pipe. The space between the jaws should not only be broad, but should also be hollowed out, a condition which will show that the parts are of firm texture and free from excess of loose connective issue (p. 30). The old practical rule of finding whether a horse is wide enough between the jaws, is to try if the clenched fist can be placed within the hollow. I venture to think that few horses could successfully pass this test, if it were applied with an ordinary-sized man's hand. When this space is broad and well hollowed out, the horse will naturally be able to bend his head more freely than when it is narrow, and he will, consequently, be pleasanter to ride and drive.

Setting-on of the Head.—The part where the head is set on to the neck should be lean and muscular, and should show a slight depression behind the ears and lower jaw, and also above the wind-pipe. This will indicate absence of an excess of loose connective tissue, and ability on the part of the horse to bend his head freely. The beautiful manner in which the neck "runs into" the head of some horses, is due to the arrangement of the bones of the neck and to the lean and well-developed condition of the muscles. The profile of this junction will, then, form a curve which will be a fitting commencement of the graceful, undulating line that sweeps over the neck, slightly dips in front of the withers, over which

Photo by] [CLARENCE HAILEY, NEWMARKET.

Fig. 308.—Mr. J. Gubbins's Ard Patrick.

it curves, and rising a little along the back, swells boldly over the loins and quarters, dips again at the root of the dock, and, finally, ends in the flowing lines of the tail. The setting-on of the head and the curves alluded to were beautifully exemplified in St. Simon, whose photograph (Fig. 16) is not nearly so good as I would have wished. These points also come out well in Ard Patrick (Fig. 308), Favonius (Fig. 420), Predominant (Fig. 278), and

Romance (Fig. 487). In the Arab pony, The Brat (Fig. 309), the curved line is perfect from the head to the croup; but, on account of the way he is standing, it descends too abruptly from the top of the croup to the tail. In Ormonde (Frontispiece) the head is set on to the neck in a coarse, stiff manner. The ideal contour which I have described, is evidently an affair of beauty rather than of usefulness.

Neck.—As the length of the neck indicates the length of the muscle which draws the fore limb forward (p. 43); the more we seek for speed and ability to jump cleverly in an animal, the longer should be his neck; its thickness being limited by the amount of strength the muscles have to put forth. The race-horse, hunter, and fast trotter, therefore, should have a long and comparatively thin neck, and the other classes should have their necks proportionately shorter and thicker according as they recede from the racing and cross-country type and approach that of the heavy draught animal. The operation of this rule should be restricted only so far as to allow sufficient length of neck for grazing purposes. Some heavy cart-horses have such short necks that they cannot feed off level ground with comfort to themselves. When the art of breeding is pushed to such an extreme as this, I cannot help thinking that there must be some defect in its practical working. It is evident that the combination of a large head and a thin neck is not only unpleasing to the eye, but is almost always a sign of general weakness.

The all-essential power which men possess to guide and regulate the movements of a horse, largely depends on the flexibility of the animal's neck. Were we unable to make him bend it, and to oblige him to turn his head to one side or the other in obedience to the "feeling" of the hands on the reins, he would be all but useless to us in the saddle and for ordinary harness work. I once undertook to saddle and get ridden an old entire zebra

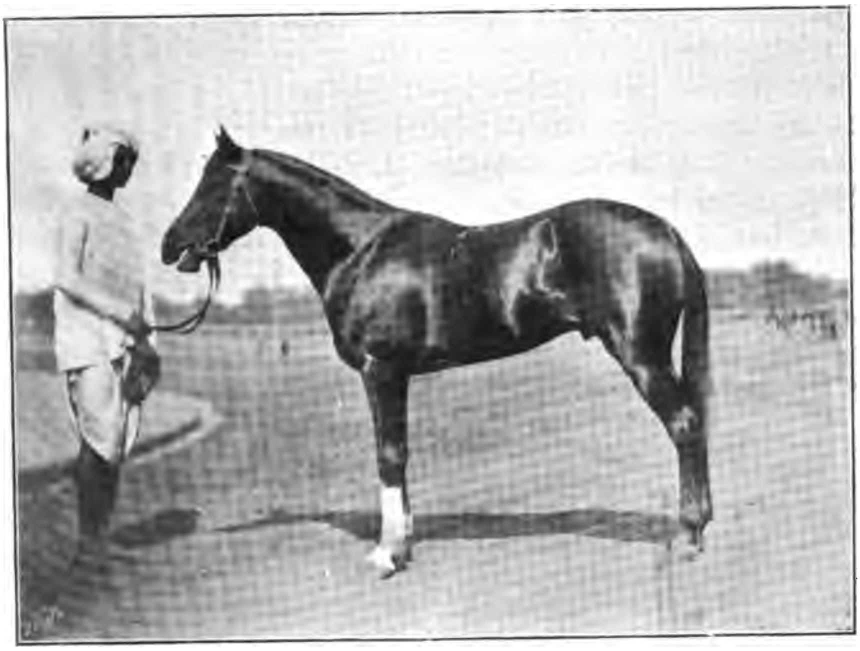

Photo by] [M. H. H.

Fig. 309.—Colonel Anderson's Arab Pony, The Brat.

Photo by] [M. H. H.

Fig. 310.—Mountain Zebra (*Equus zebra*).

(*Equus zebra*, Fig. 310), whose feet were becoming gradually deformed, on account of the animal not permitting them to be pared down. In less than an hour after I had turned it into the ring of Frank Fillis's circus, which was then in Calcutta, I had its feet rasped down to a proper level, and had it saddled and bridled for the first time in its life. It was then ridden by Steve Margaret (a brilliant Australian rough-rider) and by my wife. This was certainly the first occasion a lady ever rode this variety of zebra, which has the reputation all over the world of being unrideable. Although I was able to quickly teach it to carry its unwonted burden quietly, I made far less progress in giving it a "mouth" during the two days I had it in hand, than I would have done in half an hour with any wild Colonial horse caught for the first time on a "run;" the reason being that the zebra's neck was so stiff and strong, that I was unable to bend it in any direction. I soon taught it to do what I wanted in the circus; but when I rode it outside, it took me where-ever it liked. In fact, I had not the slightest power to either stop or guide it. Some horses, like this striped ass, though not to the same extent, are very stiff in the neck, a fact which may be owing to an obstinate temper, bad breaking in, or to a thick and rigid condition of the muscles and joints of the part. This natural want of flexibility may be overcome to a great extent by judicious "bending." As it militates against the ready turning and easy regulation of the paces of an animal, it should be regarded as a grave defect of conformation in the saddle-horse and light trapper. It may, however, be overlooked in the heavy cart-horse, whose normal pace being a walk, will not require to be as "supple" (to use a riding school term) as an animal that has to go at a faster pace, and whose line of progression, instead of being along a more or less straight road, may be across an intricate country, or in conformance with the word of command in a riding school or on parade. Besides, to have the necessary power in his fore limbs, the heavy draught animal will need massive neck muscles (p. 43) to draw them forward. When "cleverness" is essential to a horse, he should have a flexible neck, and should be able to bend and extend it with the utmost facility, so as to use his head and neck as a balancing pole for preserving the equilibrium of his body.

Some extra weight in the neck, apart from that required for the due development of the neck muscles, is

Photo by] [CLARENCE HAILEY, NEWMARKET.

Fig. 311.—Mr. Swan's Gamecock.

no detriment to the usefulness of a cart-horse; for it will aid him in "throwing weight into the collar." In the saddle horse, on the contrary, it is a great disadvantage; because it makes him heavy on his fore-hand, and would consequently render him liable to prematurely wear out his fore legs. In this connection, it is instructive to note that entires, which, as a rule, have much heavier necks than geldings, do not, when they are employed at fast paces, stand as much work, retain their "form" as long, or get into galloping condition as quickly as those which have been "added to the list." We see this rule well proved in steeple chasing and racing, as witness the long careers of those geldings, Liberator, Regal, Gamecock (Fig. 311), Reindeer, and others. For races in the early part of the season in England, geldings as a rule can be got much fitter than entires; as they need less work. As maturity of horseflesh is required far more at steeplechasing than at flat racing; the superiority of the gelding over the entire is particularly observable "between the flags." Owners and trainers who recognise the advantage of castrating those colts of theirs which do not give promise of value for stud purposes, are often deterred from putting the operation into practice, on account of geldings being ineligible for many flat events. This prohibition extends on the Continent to a few steeplechases. I think I may safely say that the large majority of colts which are not worth keeping entire for future stud purposes, should be cut not later than the end of their two-year-old racing career. The records of hunting amply prove the benefits of the operation. Mr. H. T. Barclay's Freeman, who carried his master most brilliantly for fourteen trying seasons over Leicestershire, is no solitary instance of the ability of the gelding to stand work, especially when it is of a nature, like that of jumping, to severely tax the soundness of the fore legs. The necessity of the hunter to be light in front, is a subject upon which I need not dwell here. Many experienced trainers with whom I have discussed this subject, hold the same opinions as I do on the practical utility of castration. I think that the majority of trainers will agree with me in saying that geldings not only stand fast work better than entires; but also recover more quickly from injuries of the fore legs. The lesson to be learned, from a conformation point of view, from the foregoing remarks, is that the racer, chaser, and hunter should be light in the head, neck and shoulders.

The neck, with respect to its contour, is designated high-crested (or convex, Fig. 312), straight (Figs. 275 and 277), or ewe-necked (concave, Fig. 307), as the case may be. The contour varies a good deal according to the manner the animal holds his head, and should be judged by the form it assumes when the horse stands in an ordinary manner at attention (p. 79),

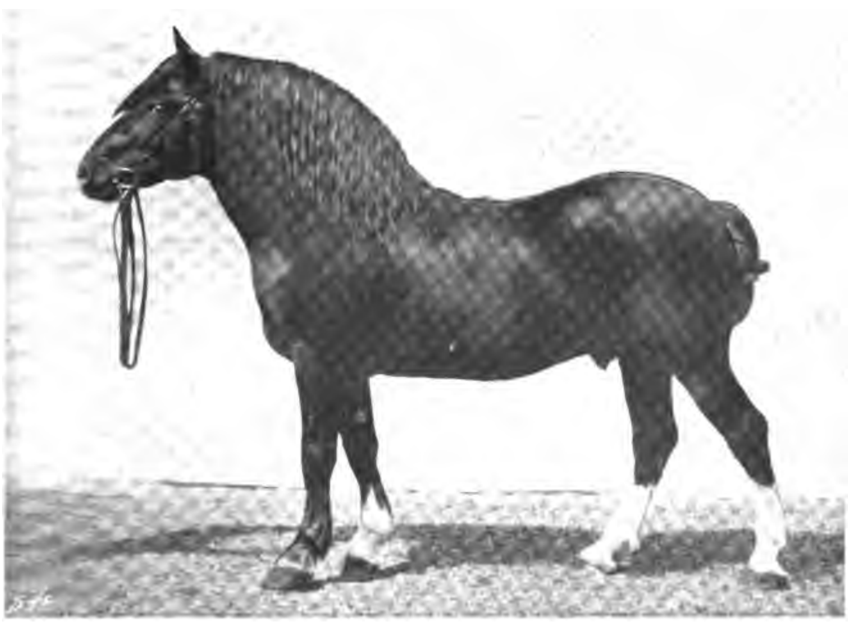

Photo by] [J. DELTON, PARIS.

Fig. 312.—Ardenne Stallion.

with the line of its face at an angle of about 60° to the ground. Some horses, especially coarse bred entires, have a very high and thick crest (Fig. 312), from an excessive amount of fat having been deposited above the suspensory ligament of the head and neck. Such a formation, from overloading the fore-hand, is a marked defect in any kind of saddle-horse. A slight convexity of crest in a lean though fairly muscular neck, as in Fig. 309, is a beauty.

The fact of a horse being ewe-necked seems to be of no detriment to his speed. It might, however, affect his handiness, on account of depriving, to some extent, his rider or driver, as the case may be, of command over him; and by causing his head to be brought into a direction which might prevent him seeing clearly where he is going. On page 84, *et seq.*, I have discussed at some length the subject of the carriage of a horse's head and neck.

In saddle-horses, the place where the neck comes out of the chest should be marked; above, by a slight depression in front of the withers; below, by another depression at the point where the jugular groove meets the chest; and at each side, it should be nearly flat with neck and shoulder. In cart-horses, the large muscles of the shoulder stand out in prominent relief from the neck, and the dip in front of the withers is either absent or but faintly indicated. Owing to the comparative lightness of the neck in mares and geldings, the union of the neck with the head and trunk is better marked in them, than in entires.

Mane.—When the mane is in a natural condition (Fig. 306), it falls on both sides of the neck in a more or less evenly distributed manner, and serves as a very efficient protection to the neck against the attacks of flies. In this case, the hairs of the mane form a whisk which is set in motion by the horse shaking his head and neck. This instinctive movement is utilised by circus men who train horses to answer a question in the negative, by shaking their heads. At first, they take a pin between their fingers, and stick it into the neck of their equine pupil, who, thereupon, instinctively shakes his head. After several repetitions of this annoying lesson, the horse will shake his head, in anticipation of the pin-prick, as soon as the man's hand approaches his neck. To obtain an affirmative answer by the horse bowing his head, all the man has to do, is to use the pin in a similar manner on the animal's breast, which the horse has to protect from the irritation of flies by his muzzle, because his breast is not provided with a hairy whisk or a twitching muscle (p. 42). When a horse which has thus been trained, is brought before an audience in the circus, he will signify "yes" or "no," with unconscious humour, as answers to the funny questions of his trainer, who obtains the desired replies by a simple wave of the hand towards the animal's breast or neck, as the case may be.

As the neck of a horse is particularly sensitive to the attacks of flies, all horses which are kept in the open, should be allowed to have long manes.

Throat.—The wind-pipe should be large and well detached from the neck; as it will then indicate good breathing power. Roaring often accompanies a wasted appearance of the tissues which cover the larynx, and is caused by paralysis of one or both of the muscles which open the larynx. The size of these muscles is too small to account for this peculiarly emaciated condition.

consideration of the conformation of the chest, which is influenced chiefly by the shape, size and setting-on of the ribs. The points which we should seek for in the ribs of a horse, in order to obtain the best possible breathing power, are :—

1. Convexity (roundness) of ribs (" barrel ") behind the shoulders.

2. Good length of ribs.

3. Ribs well inclined to the rear.

The convexity of a curve may be measured by the proportion which its height (*c d*, Fig. 313 or Fig. 314) bears to the length of its chord *a b*. Thus, if *c d* is equal to $\frac{1}{2}$ *a b* in Fig. 313, and equal to $\frac{1}{6}$ *a b* in Fig. 314, the curve *a c b* will be three times as convex in the former as in the latter.

Among the higher animals, we find that chest capacity

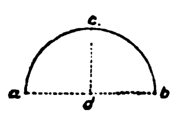

Fig. 313.—Semi-circle.

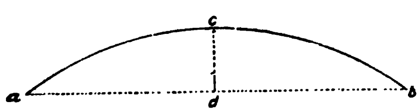

Fig. 314.—Arc of Circle.

is obtained either by convexity or by length. Hence, animals which have short chests have round ones, and those that have long ones have them flat-sided, the capacity being increased by roundness of the ribs and decreased by flatness of these bones. We have already seen that undue length of body is detrimental to speed, weight-carrying power, and strength in draught. Consequently, we should seek for roundness of chest in order to obtain good breathing power Youatt, in his book on *The Horse*, appears to have originated a fallacy concerning the conformation of the ribs which has been repeated by many English writers. He says that " the circular chest could not expand, but every change of form would be a diminution of capacity." This statement seems to be based on the supposition that the chest expands and contracts by the ribs opening and closing in a direction at right angles to the length of the body. Instead of this being the case, the difference in capacity of the chest is due to the fact of the ribs, which are inclined to the rear, turning round towards the front on their upper and lower ends, as on pivots, when air is drawn into the lungs, and then revolving back again when the air is expelled from them. We may here note that the (tidal) air is expelled from the lungs by the elastic recoil of the ribs, which takes place the moment the muscles which drew the ribs forward become relaxed. Youatt's statement is altogether incorrect; for the rounder the ribs are, other things being equal, the greater will be the difference between the chest capacity when the lungs are full, and its capacity when they are comparatively empty.

We may prove the foregoing remarks as follows: Let the shaded oval in Figs. 315, 316 and 317 diagrammatically represent the space respectively enclosed between three pairs of ribs of different degrees of convexity, but of the same depth, viewed from behind, at the end of an expiration. Let $a\ b$ (= $a\ b^1$) be the distance of the centre of each rib from its vertical axis, $b\ a\ c$ the angle at which the ribs in all three figures are inclined to the rear, and $b^1\ a\ b$ the angle through which they respectively turn during an inspiration. We shall then see that the difference of capacity—shown by the difference of area between the shaded oval and the one which circumscribes it—is greatly in favour of the round barrel. If it were possible to have a chest perfectly circular (as in Fig. 317) at the end of an expiration, the transverse axis of the chest when the lungs were fully inflated, would exceed in length the vertical axis.

The second desirable condition—namely, good length of ribs—should, as we have seen, be obtained rather by rotundity than by the distance which the respective ends of the ribs are from each other. If the ribs are sufficiently round, we need not trouble ourselves much as to their length, except as regards the farthest back ones, which should be as long and directed as much outwards as possible, so as to afford a broad attachment to the diaphragm (p. 50). It would be easy to prove that the more inclined the ribs are to the rear, the greater will be the difference in capacity of the chest, when empty, to what it would be when full of air, and consequently, the better the breathing power; but I do not think that it is possible to estimate this inclination with sufficient accuracy to make it a practical guide. Experience leads me to conclude that all useful purposes in this respect will be served, by satisfying ourselves whether or not the horse under examination is "well ribbed up." If the last rib be short, flat, and but little inclined to the rear, the animal will be "slack

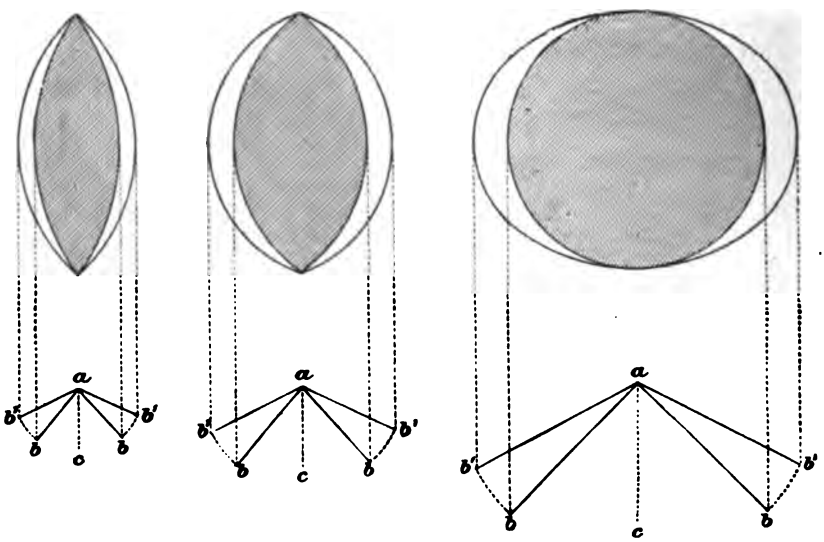

Fig. 315. Fig. 316. Fig. 317.

DIAGRAMS SHOWING DIFFERENT DEGREES OF EXPANSION OF CHEST.

in the loins," and certainly will not have as good breathing power as he would have had, if that rib was long, "springing" well out from the side, and inclined so much to the rear, that there would be space only for the ends of two or three fingers between it and the point of the hip. Such a desirable shape would give the utmost width of base to the diaphragm, which is a very important muscle of breathing. Although, in this connection, I mention only the last rib, I take for granted that its neighbouring ribs would conform, more or less, to its length, shape and inclination to the rear. As a rule, the shorter

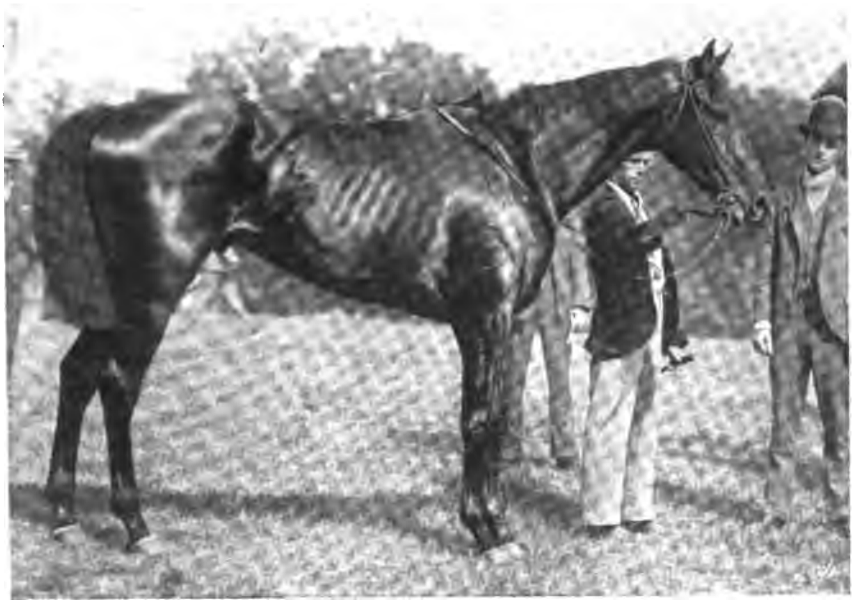

Fig. 318.—Mr. J. Buchanan's Epsom Lad.

Photo by] [M. H. H.

Fig. 319.—Thorough-bred "Weed."

the last rib, the greater is the successive diminution of the length of the false ribs from front to rear. Hence, when the last rib is relatively short, the angle which the lower line of the chest makes with the ground, will almost always be greater (Figs. 318 and 319), than when the horse is well ribbed up, like Ormonde (Frontispiece). Here, the animal's "condition" should of course be taken into account. When a horse is in hard condition (Figs. 275, 324, and 427), the rear end of this line curves more or less upwards; but in fat horses (Figs. 11 and 320) and in mares in foal (Fig. 321), the abdomen, at a point midway between the elbow and stifle, is often nearer the ground than the "girth place." In the weight-carrying hunter, the front half of this line should be nearly parallel to the ground (Fig. 322). In this connection, it is interesting to compare the conformation of the greyhound (Fig. 8) with that of the foxhound (Fig. 323), the former being noted for his speed; the latter, for his endurance. The photograph of Irish Lassie (Fig. 324) was taken immediately after she had accomplished her remarkable feat of carrying her young French owner, M. Cottu, from Vienna to Paris, a distance of 785 miles, in 12 days and 14 hours. The fatigue she went through gave no undue upward slope to the lower line of her chest, although she was very light in condition, as we may see by the way her ribs appear in the photograph. We may be quite certain that she would not have returned "fit and well," had she been of the "herring-gutted" type, supposing that she had not died on the way. The subject in question is well illustrated by Figs. 325 and 326, the photographs of which I took in South Africa in 1901. During the war, the horse in Fig. 325 went through a great deal of hardship without losing condition; but the one in Fig. 326, though well bred and fast at first, proved useless from lack of endurance. Horses of the foxhound type, like those in Figs. 322, 324 and 325, can carry plenty of animal fuel, and consequently fulfil the con-

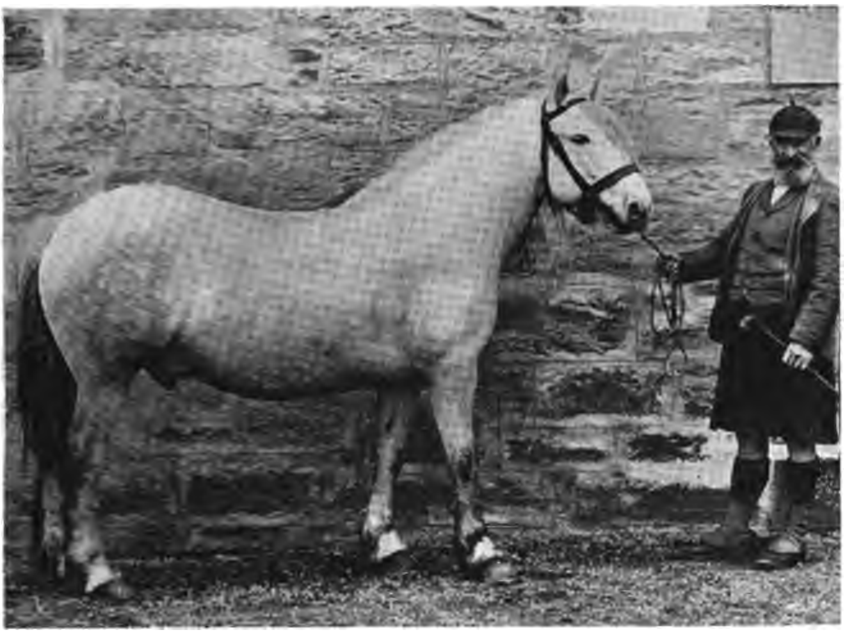

Photo by] [M. H. H.

Fig. 320.—Duke of Atholl's Highland Garron.

Photo by] [M. H. H.

Fig. 321.—Shetland Pony Mare in Foal.

ditions of endurance which have been discussed on pages 8 to 11.

It is instructive to note that the steeplechase horses, Midshipmite (Fig. 346) and Specs (Fig. 342), which were both "light" in the back ribs, were poor stayers, although they were fast and good jumpers.

The popularity of "show condition" among horse exhibitors is chiefly due to the fact that obesity is the best means for concealing the defect of short back ribs.

From the foregoing considerations, we should regard roundness of barrel behind the girths; depth of body (as compared to length of body) in the centre of the back; and being well ribbed up, as the great signs, in conformation, of a horse having good breathing power. As the middle false ribs are those which have the greatest power of being drawn forwards and outwards (p. 41), they, in comparison to the length of the body should be as long, as well as convex, as possible. On account of their lower ends being difficult to trace in the living animal, we may conveniently judge of their approximate lengths, by the depth of the body at the centre of the back, and by the slope of the lower line of the chest; making due allowance for the "condition" of the animal. The shape of the body should of course be judged by the body itself, and without reference to the length or substance of the legs. The fact, as often occurs, of the body being too heavy for the legs, in no way affects the proportion which its length, depth and thickness bear to each other.

The popular term, "slack in the loins," which has been used, is often applied to the objectionable condition of the last rib being short and at a considerable distance from the point of the hip. This expression is not altogether inappropriate, because the ribs are united by joints to the vertebræ, and consequently their length, as a rule, is proportionate to the size of these vertebræ, which is proportionate to the strength of the muscles that are attached to these bones. Hence the longer the ribs, the stronger will the muscles of the back and loins generally be. Some persons think that it is an advantage for a horse, as regards speed, to be a bit "slack in the loins;" because (so they say) such a shape allows the animal more freedom in bringing his hind legs forward, than if he were well ribbed up. It is evident that the form of a horse's back ribs cannot in any way affect

Photo by] [M. H. H.

Fig. 322.—Mr. W. H. Walker's Heavy-weight Hunter, Touchstone.

the action of his hind legs. This absurd reason was, no doubt, invented by some person who supposed that the hip joints were at the points of the hips! Although a "herring-gutted" conformation militates greatly against endurance and weight-carrying capacity, it is favourable to speed (as in the greyhound), because the comparative lightness of the body behind the shoulders increases the instability of the equilibrium (p. 69) at fast paces. Owing to sexual causes, mares, as a rule, are not so well ribbed up as horses. Hence, a little slackness in the hollow of the flank is not such a grave fault in them as in entires and geldings. The fact, however, remains, that for all purposes of work, a horse or mare cannot be too well ribbed up.

Merche remarks that: "Among common horses, the last rib is less arched and less carried back than among blood horses; and the flank consequently appears longer."

St. Simon, among many other great race-horses, was an instance of a fine stayer who possessed singularly little depth at the withers, but had great roundness of chest behind the girth, and also fair depth of body at the lowest point of his back. It is essential for the race-horse to obtain good breathing power by roundness of ribs, so that his body may have its powers of breathing fully developed without its length and weight being unduly increased.

The great advantage of depth in the front portion of the chest is to allow of good length of shoulder-blade, which is indispensable to the weight-carrier and jumper.

Abdomen.—We have seen on p. 50 that the trunk is divided by the diaphragm into two portions, the chest and abdomen; the former containing the lungs and heart; the latter, the stomach, liver, intestines, bladder and other organs. The ribs form the walls of the chest. The contents of the belly (consisting mostly of the intestines) are kept in their place chiefly by powerful ligaments, the principal one of which is the *abdominal tunic* (p. 40), and by muscles. These structures are respectively attached to the margin of the front part of the pelvis, to the rear part of the breast-bone, rearmost edge of the ribs, and to the sides of the loin vertebræ, thus bridging over the vacant space. We may, then, fairly assume that the lines of the abdomen should form a continuation of the general contour of the chest. As the straight muscle of the abdomen which covers the lower portion of this cavity, is the chief muscle that bends the back; the horse cannot be thoroughly "fit" for work, if this muscle is unduly pressed down by the intestines, and is consequently prevented from contracting to its full extent.

Fig. 323.—Foxhound.

Photo by] [J. DELTON, PARIS.

Fig. 324.—M. Cottu's Irish Lassie.

This straight muscle and the other muscles of the abdomen aid in the process of breathing, which will be more or less interfered with, if these muscles have to constantly strive against undue pressure from the contents of the cavity they cover. Besides, if the intestinal mass is greater than it ought to be, it will hamper the action of the lungs by forcing the diaphragm too far into the chest; it will add to the weight to be carried; and will militate against speed by tending to bring the centre of gravity to the rear, and by thus increasing the stability of the equilibrium (p. 69). Although the subject of feeding is not within the province of this book, it may not be out of place if I point out that the practice of giving horses large quantities of soft food (boiled turnips, for instance), which they can quickly consume, exerts, among other evils, an injurious effect on the muscles of the stomach, intestines and abdomen; for, being deprived of the rest which is necessary to their repair and development, by the continued pressure resulting from the presence of the bulky food, these muscles soon become ill-fitted to perform their work. On the other hand, we should guard against a "tucked up" condition of belly, which will indicate illness, over-work, too excitable a temperament, or improper management of some kind. If we consider that these abdominal muscles act by tending to become straight between their points of attachment, and that, when in a passive state, they are longer than when they contract, we shall see that, when in a condition of rest, they should be gently rounded, and should be neither drawn straight nor bulged out. On pages 355 and 356, the special development of these muscles will be considered.

Withers.—The chief object which the withers fulfil, is to afford attachment for the suspensory ligament of the head and neck; for muscles which extend the head and neck; for muscles that draw the shoulder-blade forward; for the powerful muscle that runs along the top of the back and extends the vertebræ; and for a muscle which aids inspiration by bringing the ribs forward.

Photo by] [M. H. H.
Fig. 325.—Well-ribbed-up Australian Cavalry Horse.

Photo by] [M. H. H.
Fig. 326.—Herring-gutted Australian Cavalry Horse.

If we look at the skeleton (Fig. 18), we shall readily see that the fact of the withers rising, as they do, above the line of the back, greatly assists the action of the elastic ligament that supports the head and neck, and of the muscles which extend these parts. It also increases the power of the muscle which extends the back and loins. Besides, it tends to give length to the muscle which is attached to the withers and which helps to draw the shoulder forward, and by affording increased space for the top of the shoulder-blade, it favours length of this important bone. The farther back the withers extend, the more do they, by giving a broad surface for attachment, indicate large development of the muscle which extends the back and loins, and the more room do they afford for the backward slope of the shoulder-blade. Hence, withers which are high and which extend far back, are generally associated with a good carriage of the head and neck; free movement of the shoulders; long and sloping shoulder-blades; and strength in the back and loins. Such a conformation is desirable in every kind of horse, and especially in the race-horse, hunter, and steeplechaser. Low withers, on the contrary, are usually accompanied by heavy, short and upright shoulders. Lecoq observes that "in the mule, and especially in the ass, the withers are always low; a conformation which is in accordance with the small development of the paces of these animals." Dealers and others, when "showing off" a horse which has high withers, not unfrequently endeavour to direct attention to this fact, as a proof of the length and obliquity of the shoulders. I need hardly point out, even to inexperienced horsemen, that any particular part should be judged, if possible, on its own merits, and not by those of another part, however much excellence in the latter may indicate its possession by the former.

The Height of the withers is, strictly speaking, that of the spines of the vertebræ of the part and the soft tissues which cover their summits. Their apparent height is the distance they project above the top of the shoulder-blades; although it is often difficult to tell how high they are in horses which have very thick withers. Animals that are comparatively high over the croup, appear to have lower withers than those which are high in front, even when we make allowance for any difference that may exist in the length of the spines themselves. The reason for this seems to be, that, as elevation of the croup causes the weight of the body to be shifted forward; such a conformation tends to depress the body between the shoulder-blades, and consequently reduces the distance between them and the top of the withers.

"Age and sex have an equal influence on the leanness of withers, which, badly defined in the colt, come well out only towards five or six years old, at the time when the bones have attained their full length, and the body its definite size. The withers are less high in the mare than in the gelding or entire. As a set off, the last mentioned, whose fore-hand acquires a considerable development, has this part thicker, especially in the case of a heavy draught animal" (*Goubaux and Barrier*).

As the withers afford attachment to the suspensory ligament of the head and neck (*ligamentum nuchæ*), the bony development of the withers will usually be proportionate to the thickness (strength) of this ligament; its thickness being proportionate to the weight which it has to support. As the weight of the head and neck of an entire is relatively greater than that of a mare, the spines of his withers (p. 36) will be higher than hers, supposing that, in other respects, the two animals are of similar conformation. Although early castration prevents, to a considerable extent, any marked difference occurring between the muscular and fatty development of the neck of the gelding and that of the mare; it does not appear to check the bony development of the withers. Therefore, the neck of an ordinary gelding resembles that of a mare; and the height of his withers, that of an entire.

Regarding the bones of the head, neck and withers as a lever, which in this case is of an extremely complicated nature, we find that the longer the neck, the greater is the strain which the weight of the head places on the *ligamentum nuchæ*. Consequently, the spines of the withers are more largely developed in horses which, like thoroughbreds, have long necks as compared to the size of their bodies. Writing on *The Rate of Growth in the Horse*, Professor Ewart points out that in the male wapiti, the spines of the withers are long; but in the female wapiti, they are practically absent, because her head is not adorned with horns, which, in her consort, are very heavy. We have already seen (p. 184) that the length of the neck corresponds to the length of the fore legs, and not to the dimensions of the body.

The Width of the Withers—constituting " thick withers " or " thin (lean) withers," as the case may be—depends on their apparent height ; actual thickness of the spines and their cartilages ; size of the muscles of the part ; and the amount of loose tissue about it. Although we cannot expect leanness of withers in the cart-horse, the presence of whose massive muscles that lie between the trunk and shoulder-blades, separates the ends of the latter widely asunder ; still it is a very desirable point in the saddle-horse, as it indicates absence of an excess of connective tissue (p. 30), lightness of fore-hand, and height of the withers themselves. In this class of animal, very thin, high withers are objectionable ; for they are liable to become hurt by a saddle. We are all aware that when the part is of this shape, it is difficult to keep the " gullet-plate " of the saddle from touching it, however high this iron arch may be ; the probable reason being, that such a condition is usually associated, as might be expected, with emaciation of the neighbouring muscles ; as for instance, that which gives rise to the prominence (" saddle muscle," *see* p. 270) behind the shoulder-blade, and behind which the " points " of the tree of the saddle should rest.

When the part is thus unduly flat, the saddle is naturally liable to slip forward. Also, with horses which have thick withers, it is often difficult to keep the saddle in its place; for the presence of large shoulder muscles and abundance of connective tissue conceal the outline of the

Photo by] [J. DELTON, PARIS.
Fig. 327.—Front view of the Boulonnais (French) Cart Stallion, Réjoui (Fig. 504).

Photo by] [M. H. H.
Fig. 328.—Front view of well-shaped weight-carrying Hunter (Fig. 322).

shoulder-blades and render the part, upon which the points of the tree rest, smooth and flat.

As the comparative leanness or thickness of withers greatly depends on the size of the muscles of the shoulders, I shall defer any further remarks on this subject until discussing the form and functions of the shoulders (p. 266, *et seq.*).

Breast.—The conformation of the breast has reference almost solely to the comparative width between the fore legs, which "is generally looked upon as a measure of the size of the chest, or, rather, of its rotundity. This is an error which we have cleared away by more than fifty observations made on the living animal, and afterwards completed on the dead subject. We have never been able to ascertain, with respect to this point, any practical difference among animals of the same height, whatever might have been their width of breast; for the simple reason that it is not in its front part that the chest varies much, but rather in its middle and back portions. To what cause, then, other than bulging out of the anterior ribs, is width between the fore legs due? We must attribute it to the greater or less thickness of the pectoral muscles which form its base. We may see the truth of this from the fact that this part may become narrow in animals which have broad breasts. It is merely necessary to place them under bad sanitary conditions as regards work and feeding, to convince one that their state of emaciation brings on the loss of width of which we speak" (*Goubaux and Barrier*). If we compare the width between the fore legs of badly-shaped cart-horses which happen to be "flat-sided" and wanting in girth, with that of thorough-breds having large capacity of chest, we shall note that the width in question bears no relation to the size of the chest. Again, it is no rare occurrence to see horses that have been once broad-chested, become narrow in front when they are old and worn out. The pectoral muscles, to which the eminent French professors allude in the foregoing extract, lie between the humerus and chest. As there is considerable lateral play between the elbows and chest of the horse; the width between the fore legs varies a good deal when the animal is standing, according as the fore feet are close together or wide apart. The fact that horses which are broad between the fore legs are very rarely good stayers at a gallop, has been used as an argument that roundness of rib is inconsistent with good breathing power. We may account for it more correctly by saying that the failure in "staying" is owing to the undue weight of the fore-hand consequent on the large muscular development of the part, and to the tendency to lateral displacement of the centre of gravity (p. 68). It is well to remember that the muscles which, by their large development, give increased width

Photo by] [M. H. H.
Fig. 329.—Front view of well-shaped weight-carrying Hunter.

Photo by] [M. H. H.
Fig. 330.—Broad-breasted thorough-bred mare (Fig. 305).

between the fore legs, might with propriety be considered in conjunction with those of the shoulders (p. 266), to the bones (shoulder-blade and humerus) of which they are attached at one end. The "thickness of the shoulders" is directly influenced by their development, which is naturally more or less in agreement with that of the other muscles of the shoulder. Thus we rarely see a horse wide in front which is not at the same time thick just below the withers (p. 270). As these facts are perhaps not very generally known, it is advisable, for simplicity's sake, to discuss the subject of width between the fore legs and that of shoulders separately. For further remarks on "thickness of shoulders," see page 270.

Mr. H. Wilton points out to me that horses vary very little—comparatively to their depth of body, from top of withers to brisket—in their respective "width through the heart," which is the term applied by saddlers to the horizontal and transverse measurement through the chest, at the spots touched by the ends of the points of the tree (supposing that they are both of full length) of a properly-made and well-fitting side-saddle, when it is placed in correct position on the animal's back. The point at which the measurement is taken is indicated by the letter *d*, in Fig. 350. The expression "width through the heart" is not quite correct; because the heart is situated lower down, and more to the front, than the line in question. The term is, however, well understood, and serves its purpose. Mr. Wilton gives me the following average measurements "through the heart," which he has obtained during a long experience in the fitting of side-saddles :—

19½	inches,	for a	very heavy-weight hunter (maximum).
18	,,	,,	15 or 16-stone hunter.
17½	,,	,,	13-stone hunter.
17¼	,,	,,	light-weight hunter, or thorough-bred.
16¾	,,	,,	Arab, 14.1 or 14.2 high.

These figures certainly prove that comparative width of breast, or width between the fore legs, is not dependent, or only to a very slight extent, on width of chest. As this measurement of "width through the heart" is taken behind the shoulders, their condition can in no way affect it. In considering the list of measurements given by Mr. Wilton, we must bear in mind that the more weight a hunter can carry, the "deeper" will his chest be, as a rule, and that light-weight hunters and thorough-breds are deeper in the chest than Arabs, which are comparatively small horses. Hence, we may regard the respective proportions between width and depth of chest in this list, as fairly uniform.

When a horse is narrow between the fore legs by reason of the emaciated condition of his pectoral muscles, "the keel of his breast-bone becomes prominent, the points of the shoulder are pushed forward to the front, and allow

Photo by] [M. H. H.
Fig. 331.—Broad-breasted Carriage Horse.

Photo by] [M. H. H.
Fig. 332.—Front view of well-shaped T.B.

to be seen, between them and the breast, two deep depressions in which the jugular grooves terminate below" (*Goubaux and Barrier*). These writers point to the fact that narrowness in front may therefore be either natural or acquired. In a cart-horse, a broad breast (Fig. 327) is a desirable point; for he requires to have massive muscles. Close observation of thorough-breds convinces me that a race-horse cannot be too "narrow in front;" provided that his fore legs are properly shaped and properly "put on," and that the action in front is consequently "true." Undue narrowness of the chest may arise from the elbow being turned in and the toes turned out, as in Fig. 57, which represents a defective conformation of the part. The increase of width between the fore legs in proportion to weight-carrying power, is but slight in the well-shaped hunter, as we may see in Fig. 328, which is the front view of a particularly strong and active fifteen-stone hunter (Fig. 322). Fig. 329 is the front view of another powerful fifteen-stone hunter that could gallop, jump and stay with the best. We see in Fig. 330 the same view of a thoroughbred (Fig. 305) that was particularly thick, for a clean-bred horse, in the shoulders, and far too wide in front for galloping. The muscles of the fore-arm in this figure contrasts, as regards development, unfavourably with those of Fig. 328. Those of my readers who have followed me up to the present point, will of course understand that in the saddle-horse, the proportionate development of the muscles which give width between the fore legs (those of the shoulders), should never exceed that of the muscles of the fore legs. Fig. 331 gives a front view of a carriage horse which was too broad between the fore legs for saddle work. Fig. 332 is a front view of a well-shaped race-horse which is of ordinary width between the fore legs. Sections of the chests of the horses shown in Figs. 329 and 331 are given in Fig. 349.

Back and Loins.—The upper line of these parts should, for beauty, run in a straight line, or with the slightest possible rise, to the croup (Figs. 16, 338, 416, 433 and 486). When the animal has a "roach-back" (Fig. 333)—that is to say, when this line is decidedly convex—the muscle which runs along the top of the back, and which has a powerful action on all the paces of the horse, will be wanting in development, and the chest will, as a rule, be flat-sided. This condition of back, from the fact of its

Photo by] [M. H. H.

Fig. 333.—Roach-backed and Goose-rumped Horse.

Photo by] [M. H. H.

Fig. 334.—Hollow Back from Old Age.

assuming, to some extent, the form of an arch, is generally supposed to be advantageous for carrying heavy burdens, as in the case of pack animals, although there does not appear to be any actual proof that such is the case. A "hollow-backed" or "saddle-backed" horse, on the contrary, is one which has this line concave, on account of the arrangement of the vertebræ of the part. It is frequently the result of relaxation of the ligaments which bind the vertebræ together, owing to the effects of hard work and debility. Thus, we may often see a horse, which in his youth had a straight back, become hollow-backed in his old age (Fig. 334). From the different position assumed by man when moving, the opposite to this occurs in ourselves. An appearance of hollow-back (Fig. 305) may be given by unusually large development of that part (*posterior iliac spine*, Fig. 18) of the pelvis which forms the highest point of the croup. I have also observed—especially among Arab ponies—the same kind of conformation arise from the pelvis being set up particularly high in animals which were low in front. No fault can be found with an apparently hollow back produced by the large development of the pelvis.

Without any exception, the loins and back, at the region of the cantle of the saddle, should be as flat and broad as possible; for this condition indicates the presence of powerful rearing muscles (p. 67), and rotundity of the back ribs. In many draught animals, the upper muscles of the loins and back stand out as distinct ridges of muscle on each side of the backbone (Fig. 335). This beauty in the coarser breeds is not confined to them, but may sometimes be seen in well-bred horses, as was the case with Mr. Kelly Maitland's Kingcraft, which was one of the best race-horses that has ever been in India. This Australian was a singularly muscular, short-backed animal, to whom distance and weight made, comparatively, but little difference. This "double-backed" condition may come on or disappear according to the amount of "flesh" which the animal carries. A false appearance of flatness and strength of back and loins, and of roundness of barrel, may be temporarily given by "show condition" (excessive fat).

In default of a generally accepted expression, it might be well to use the term, "wedge-shaped loins"

Photo by] [J. DELTON, PARIS.
Fig. 335.—Rear view of Boulonnais (French) Cart Stallion, Turbot (16-2½).

(namely, loins which slope downwards on each side from the middle line of the back), in contradistinction to "flat loins" (Fig. 336). We must take into consideration that a wedge-shaped appearance of the loins may be caused by undue length of the spines of the vertebræ of the part, and not by deficiency of muscle, in which case the loins will be more or less "roached."

Shortness of Loins and Back.—The appearance of comparative shortness or comparative length which the back and loins (or back, if we include the loins in this term, *see* p. 17) may present, is due, I would submit, chiefly to the following causes:—

1. The manner in which the croup runs into the loins. For instance, the back and loins will appear short and the croup (or "quarters") long, if the pelvis be more or less horizontal; the contour of the croup free from angularity; the muscles over the loins largely developed; and the flanks well ribbed up. We may here compare Fig. 337 with Fig. 338, and Ormonde (Frontispiece).

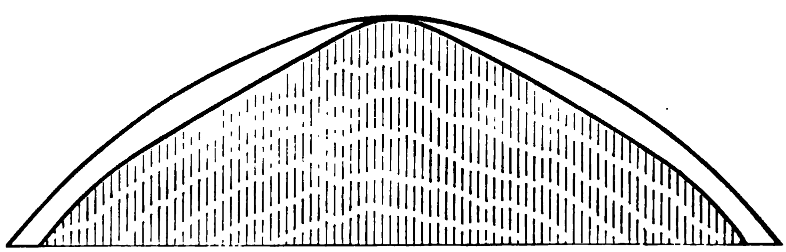

Fig. 336.—Sections of loins.

The shaded portion of this figure represents the upper part of a transverse section of the loins, just behind the cantle of the saddle, of a horse with "wedge-shaped" loins; and the whole figure (shaded portion and that outside it), that of a horse with fairly flat loins.

2. The distance to which the withers run back. We may observe that the extreme lowness of the withers in the onager (Fig. 339) and Nubian wild ass (Fig. 402), gives the backs of these animals a false appearance of undue length. The angularity of the contour of Mike's croup (Fig. 279) might lead one to form the wrong opinion that he was long in the back and loins, if his withers did not extend so far to the rear, as to counteract that impression.

3. The degree of slope of the shoulder and pelvis. It is evident that the greater the angle formed by the respective directions of the shoulder-blade and pelvis produced (the more oblique the shoulder and the more horizontal the

croup), the shorter will the back and loins appear to be; and *vice versâ*.

4. Length of neck. It is evident that a long neck (or a "long rein," if we include the withers) will give an air of shortness to the back and loins; and *vice versâ*.

5. Depth of back ribs. Compare Ormonde and Cloister (Frontispiece) with Figs. 9 and 318.

Without indulging in any tedious repetition, I think we

Photo by] [DIXON & SONS.

Fig. 337.—Mr. W. H. Walker's Water Lily.

may safely assume that, in all cases, a horse's back and loins should have the appearance of being as short as possible.

Points of the Hips.—When these parts are very prominent, the horse is said to have "ragged hips." Such a condition gives the animal an angular appearance, and is consequently displeasing to the eye. A horse thus formed is more likely to hurt his hips by knocking them against door-posts, or by lying on a hard surface when he is not supplied with a sufficiency of bedding, than one of different conformation. The fact of the hips of a horse being flat or ragged does not appear to influence his usefulness in any way. Among thorough-breds, certain strains of blood have them prominent. Although it might be more correct, from a conformation point of view, to consider the points of the hips along with the hind limb ; I have placed them, for convenience' sake, under the present heading. We should bear in mind that the state of a horse's condition has a good deal to say to the shape of his hips ; for we may often see that an animal which had ragged hips when he was thin, has them rounded when fat.

Flank.—The only thing to remark about this part is that the "hollow of the flank," which is included between the loins, point of the hip and end of the last back rib, should be well filled up and should be as small as possible. If it is hollowed out, it will indicate that the animal is in bad health, out of condition, or of weak constitution. If the extent of the hollow of the flank be small, the animal will be well ribbed-up, a form of conformation which has been discussed on p. 229, *et seq*.

Croup.—The upper line of the croup, from the loins to the root of the tail, should remain convex, even when a fairly heavy weight is carried. This convexity, more or less regular, is caused by the prominence of the inner angle of the pelvis ; by the action of the muscles which flex the back ; and by the strength of the ligaments which preserve the stability of this arch. We may note how relaxation of these muscles will affect this state of convexity if we pinch the loins of a horse, so as to make him crouch, which he does by the contraction of the muscles that lie on the top of the loins. When he crouches in this manner, the upper line of the croup will tend to become straight. Hence we may accept the conclusion, which is fully borne out in practice, that undue straightness of the upper line of the croup indicates weakness of the part. Also, when a horse is affected by paralysis of the muscles of the loins, the croup will usually assume an abnormally flat appearance, especially when weight is put on the back, which, in this disease, can badly support it. The

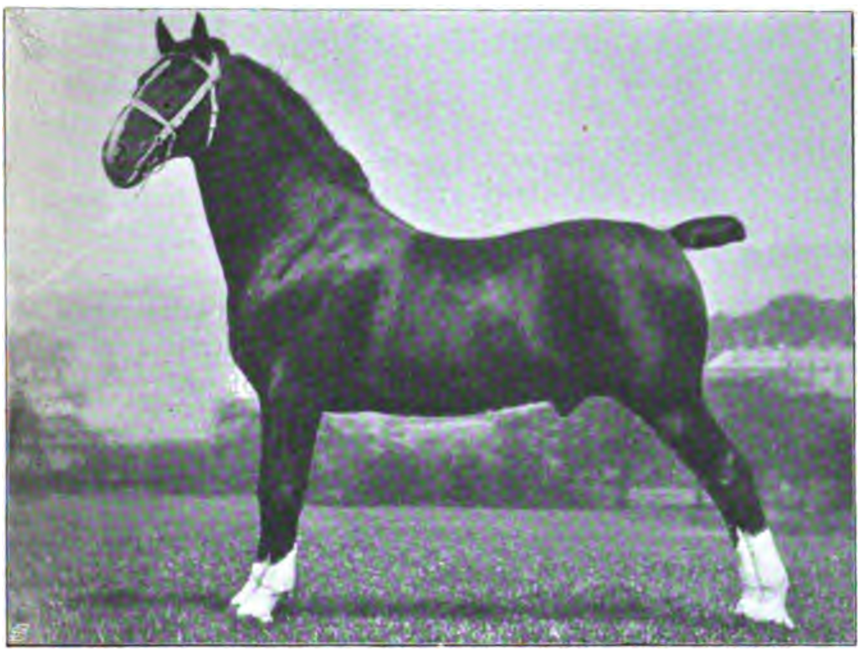

Photo by] [M. H. H.

Fig. 338.—Mr. Tom Mitchell's Hackney Stallion, Ganymede.

slope of the croup (whether it is "goose rumped" or horizontal) will be considered on pp. 308 to 311.

Anus.—The anus should be prominent, and the tissues around it should be well filled out. It should be firm in appearance and closed when at rest. A hollow, flabby and open condition of the part indicates illness or general debility.

Tail.—As the subject of the horse's tail has been discussed in [illegible], many of the [illegible] have been taken from that book. The chief function which the normal equine tail fulfils, is to drive away flies and other irritating objects which happen to alight on the hind legs, flanks, genital organs, and lower part of the abdomen. We have seen that the normal mane (p. [illegible]) performs similar good service for the neck; the normal forelock (p. [illegible]), for the head; and the muzzle for the breast. The croup is mechanically protected from these causes of irritation, by a thick layer of fibrous tissue which lies under the skin of that part (p. [illegible]). The skin of the shoulders and portions of the trunk which are not guarded in any of the ways just described, is lined with a thin and very broad muscle (p. 42), which has great power of twitching, and, consequently, of driving off flies and other causes of annoyance. In this work, these means of protection are called into play, far more in the open than in the stable, and particularly during hot weather. At grass in summer time, we may often see a long-tailed mare whisking insects off the fore-hand of her foal which stands alongside her. She intelligently places her hind quarters near his head, so that he may get the benefit of her tail, because his caudal appendage is unprovided with long hairs. Also, when a foal is lying down during the day-time, in the open, his long-tailed dam may sometimes be seen standing close to him, and whisking away with her tail any flies that are hovering about him. Such maternal acts of kindness are prevented by the cruel operation of docking; although often a miserable docked mare will, under the influence of instinct, try to carry them out. All of us who have lived among horses in the open, and especially in hot climates, know that the tails, manes and fore-locks of unmutilated horses at grass, save them from an immense amount of discomfort, like what we anyone who understands equine anatomy; although it may win the applause of an ignorant public.

The tail should be muscular at its root, and naturally short as regards its solid portion (dock). Strength of tail, as may be tested by endeavouring to lift it up with the hand under the root, usually shows vigour of body. An unusually long dock is, to a certain extent, a sign of

Photo by] [M. H. H.

Fig. 340.—Mrs. Hayes' Arab pony, Freddie.

inferior breeding, as it is a reversion to an early type of ancestor.

The tail should, as a rule, be set on "high" (Fig. 340); as this form points to a more or less horizontal position of the sacrum. If this part be bent downwards, as in Fig. 333, so as to form a decided angle with the vertebræ of the loins and back, the backbone will not be as well adapted to general purposes of locomotion, as it would be if it were comparatively horizontal.

During movement, the tail should be carried well away from the quarters; for this will indicate that its muscles are in good order. Some horses, especially those of high spirit and good blood, when going fast, carry the tail "like a flag," having the dock raised and more or less concave. It looks very bad if the tail, when carried low down, say, at the walk, has a concave bend in it, particularly if there be an abrupt turn or "kink" in the tail near its end. Such a carriage of tail is usually supposed to be associated with an "ungenerous" disposition; although this is not always the case. In coming to a decision on this subject, we should not fail to take into consideration the indications afforded by the eyes and ears. Thus, if a horse, although carrying his tail "meanly," has a "kind," fearless look about the eyes, and keeps his ears well to the front, and works them in a quick decided manner, we may reasonably conclude that the defective carriage of the tail is due to faulty conformation, and not to a sulky disposition, which would be the greater of the two evils. In making these remarks, I am, of course, alluding to horses that have not been docked.

Any unnecessary whisking of the tail when the animal is in motion, is objectionable; as it is often a sign of "jadiness" and bad temper. We may occasionally notice that the fact of an animal being beaten in a race or steeplechase, is first made manifest by the tail beginning to go round and round. The swishing of the tail may here, however, be due rather to the application of the spurs or whip, than to any "unkind" running on the part of the horse. On the other hand, we may observe instances of thoroughly game race-horses, when "finishing," being so engaged in the keen struggle for victory, that they will keep the tail without movement, even under severe "punishment." Mares, as a rule, whisk their tails about more than horses and geldings. Some of them which are in a state of continual irritation from sexual causes, do so to an extent that is very unpleasant to their riders or drivers. The operation of ovariotomy will generally cure such animals of this disease (nymphomania). Almost all Arab horses, and certain horses in all countries, keep the tail rigidly fixed to one particular side, near or off, when walking, unless, indeed, to use it when occasion demands. English thorough-breds, however, at the same pace, generally swing it from side to side in an easy, free manner, somewhat similar to that in which a fast and fair walker uses his arms when going along at, say, the rate of six miles an hour. The difference, here, seems to be due to the thorough-bred's longer stride and greater freedom of action.

CHAPTER XVIII.

THE FORE LIMB.

General View of the Fore Limb—Chief Duties of the Fore Limb—Fore Legs in Saddle and Draught—The Shoulder—Humerus—Elbow—Fore Arm—Knee—From Knee to Fetlock—Fetlock—Pastern—Hoof.

General View of the Fore Limb.—As explained on page 36, I apply the term "fore limb" or "fore leg" to the column of bones from the shoulder-blade to the hoof (inclusive), and the attendant soft parts. As the chief muscles of the neck are concerned in the movements of the fore limb, we must take into consideration the conformation of the former part while studying that of the latter. The shape of the muscles which lie between the upper portion of the limb (above the elbow joint) and the chest, must not be neglected; for they, respectively, connect the limb to the trunk, and draw it upwards and backwards. The size of some of them, as mentioned on p. 244, regulate the width between the fore legs. As the action of the neck muscles, with regard to the fore limb, has been considered in Chapters X. and XVI. (p. 86 and 218), and that of the other muscles in Chapter IV. (pp. 43 and 44), they need not be specially noticed here. I shall now examine the nature of the work which the fore limb has got to do, with the object of drawing conclusions as to the conformation most suitable to it in particular cases. As its various parts should move in harmony together, it will at first be more profitable to study them collectively than particularly.

Chief Duties of the Fore Limb are—(1) to support weight; (2) to resist the injurious effects of "work" on its own structures; (3) to preserve the stability of the body; (4) to propel the body forward or backward; and (5) to raise the fore-hand.

To support weight, the horse requires bones and muscles strong in proportion to the nature and amount of work to be done; a more or less straight condition of the bones; and a shoulder-blade sufficiently large for the muscles which attach it to the trunk, and whose size is a measure of their strength. The comparative straightness of the column of bones will be largely affected by considerations of propulsion and of the effect of work on the legs. In all cases, the bones at the knee should be straight.

To resist the injurious effect of "work" on its structures, the bones of the shoulder and pastern (at each respective end of the limb) should be placed obliquely, if the ground be hard, so as to diminish the injurious effects of concussion, which are seen in, for instance, navicular disease, laminitis, ringbone, wind-galls, "sore shins," and splints. The obliquity, however, will be obtained at the expense of mechanical advantage. Hence, the softer the ground and the slower the pace; the less sloping need the shoulder and pastern be, to avoid the injurious effects of concussion.

To preserve the stability of the body, we require sloping shoulders and sloping pasterns, both of which aid in raising the fore-hand. With sloping pasterns, the danger of catching the ground with the toe is reduced; for the more oblique the pastern, the easier will it be for the horse to bring his heel first on the ground at each step.

To propel the body forward to the best advantage, we require a humerus not much removed from a horizontal position; for the pushing force derived from the fore limb takes place through that bone. Also, in propulsion, the muscles which bend the fetlock joint will act best, when the pastern is upright (p. 73). Nothing need be said here about backward propulsion, as it has but little bearing on conformation. Some remarks on reining-back have been made on page 129 *et seq.*

To raise the fore-hand effectively, we require, as I have just said, obliquity of shoulder-blade and pastern, so as to favour the straightening of the limb (p. 66).

From the foregoing observations we may see that the conformation most suitable to one function of the fore limb, may differ essentially from that best adapted to other offices performed by it. Consequently, the conformation to be sought for in the fore limb of a horse will be the best possible combination of somewhat conflicting elements.

Fore Legs in Saddle and Draught.—In draught, whether light or heavy, the pace is practically confined to the walk, trot, and, in rare cases, to the amble, in none of which is the function of raising the fore-hand tested to anything like the same extent as in the canter, gallop, and, particularly, in jumping. Hence the saddle-horse, especially the hunter, requires a lighter fore-hand and greater power of flexing and extending the joints of the fore limb, than the harness animal. Setting aside for the moment the question of the heavy cart-horse, which under all circumstances requires a maximum amount of development of bone and muscle in his limbs, we must also remember that the legs of the saddle-horse (particularly the fore ones, in proportion to the speed required) have to bear the burden of a rider, from which the limbs of the trapper are free. Consequently, the saddle-horse should have stronger legs in comparison to the weight of his body, than an animal that works between the shafts, the correctness of which remark will be confirmed by an inspection of Figs. 322, 343, 406, 427, and 487, for instance.

Fig. 341 shows a thorough-bred mare whose fore legs, for purposes of racing and steeplechasing, were too light for the weight of her body. She had a nice short back, powerful loins, and was well ribbed up; but, as I have already said, was too "heavily topped." Her conformation is the direct opposite of that of Specs (Fig. 342), who has a remarkably light fore-hand, beautiful riding

Photo by] [M. H. H.

Fig. 341.—Thorough-bred mare with light fore legs.

shoulders, and fore legs which have stood an extraordinary amount of work; but lacks the "close coupling" and good loins of the mare. The Australian horse in Fig. 343, is an admirable example of a horse with very strong legs, and a light body. An inspection of the illustrations in this book, of Hackneys, Cleveland bays and Yorkshire coach-horses will further elucidate my meaning. The remarks made here are naturally comparative; for I am of course aware that it is impossible for a harness-horse, any more than a saddle-horse, to have too good fore legs.

The Shoulder.—The popular though somewhat misguiding terms, "oblique" and "sloping," are applied to the shoulder, when the shoulder-blade is less upright than usual (Fig. 344); and the terms, "upright," "perpendicular," and "straight," when it assumes a still more vertical position (Fig. 345).

The degree of slope of the shoulder is difficult for inexperienced persons to determine, especially when the part is covered by fat or by thick muscles. French writers give rules for measuring the obliquity of the shoulder-blade by means of a clinometer, which is an operation that is not always easy to perform satisfactorily. Persons who have carefully and practically studied the subject, will find that they can rely fairly well on the results of inspection by their eyes. The horse with the most oblique shoulders I have ever seen was St. Simon (Fig. 16), whose photograph, I regret to say, does not render this point properly, as it is a little fore-shortened. The lines of his shoulder are correctly shown in Fig. 17, which is a reproduction of a photograph that had to be "faked" a good deal. As this illustration gives his exact outline taken in strict profile, it is valuable for comparison; although much of the detail which would have been given in a good photograph is wanting. Ormonde (Frontispiece), Lord Arthur (Fig. 275), Predominant (Fig. 278), Dynamite (Fig. 284), The Brat (Fig. 309), and Midshipmite (Fig. 346) had very good, sloping shoulders. We see instances of straight shoulders in Figs. 307, 333 and 347.

We have seen on pages 62 and 63 that the more oblique are the shoulders, the greater ability will a horse have to raise and advance his fore legs. Also, oblique shoulders are valuable aids to speed at the gallop, and in leap-

Photo by] [M. H. H.

Fig. 342.—Mr. W. H. Walker's Specs.

Photo by] [Gresham Studio, Adelaide, South Australia.

Fig. 343.—Mr. Barr-Smith's Australian thorough-bred, Mostyn ; a well-known winner and sire.

ing (p. 66). Consequently, obliquity of shoulder is a desirable point in every kind of horse, except in match trotters (p. 585) and heavy draught animals which work on smooth roads, and are not required to go out of a walk. If they have at times to exceed this pace, on hard ground, as dray horses have to do in London, they should undoubtedly have sloping shoulders, so that their legs may be preserved as much as possible from the injurious effects of concussion. The advantage of sloping shoulders in cart-horses which have to labour on soft ground, like that of ordinary farms, has been discussed on page 78.

In the series of levers formed by the bones of the fore leg, we find that in diminishing concussion and in raising the forehand, the shoulder joint and the joints below the knee act to a great extent in harmony. Hence, for perfect collaboration, sloping shoulders require the presence of sloping pasterns (p. 292); and *vice versâ*. We often find on riding a hunter which has shoulders apparently too upright for his work, that he is "light in front" and is capable of moving his fore limbs freely; the redeeming point in almost all these cases being good oblique pasterns. The advisability of not judging the shoulders of a riding horse solely by their appearance, is so well understood by experienced horsemen, that if an intending buyer finds fault with the shoulders of a hunter which he sees in a dealer's yard, the seller will almost always ask him to get on the animal and try him before condemning his shoulders. Also, some horses which have admirable shoulders move more or less stiffly in front, because their fetlock and pastern joints are wanting in pliability. In many Arabs, the defect of upright shoulders is mitigated to a large extent by long and sloping pasterns. Excess of weight in the muscles of the shoulders naturally detracts from any advantage obtained by the shoulders being oblique.

The thickness of the muscles about the shoulders should be proportionate to the amount of strength which the fore legs will be called upon to display. We may judge it, by the thickness of the structures just below (four or five inches) the highest point of the withers; by the width between the fore legs; by the thickness of the broadest part of the body at the point of the shoulders (Figs. 327 to 332); by the condition of the muscles

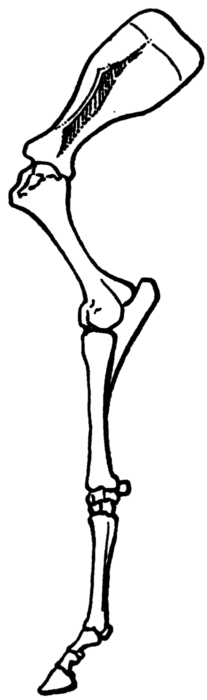

Fig. 344.—Sloping shoulder.

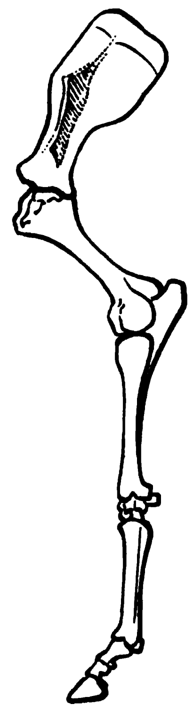

Fig. 345.—Upright shoulder.

which cover the shoulder-blade; and by the amount of depression there is immediately in front of the shoulder-blade where it joins the neck. This dip ("place for the collar") is well shown in Figs. 304, 307, and 333. The difference of level between the surface of the neck and that of the shoulder will be best observed when the neck is thin and the shoulder thick (see remarks on the conformation of Cloister, p. 387). At the same time, a properly shaped, heavy draught-horse, will always have prominent shoulders, which in him are desirable, so as to give a broad surface for pressure against the collar.

This question of thickness or thinness of shoulders is very important, especially to hunting men, and has, up to the present, received scanty notice from writers on horses. One of the first points that will strike the experienced horseman when mounted, is the condition of the "saddle muscle," which is the name usually given by London saddlers to the muscle close behind which, on each side, the points of the tree should rest when the saddle is on the animal's back. In a thick-shouldered horse, this muscle will appear as a rounded lump at a point about 4½ inches below the top of the withers (Figs. 349 and *e*, 350). To explain my meaning, I have given in Figs. 348 and 349 sections (viewed horizontally) through the shoulders of four different kinds of horses, made respectively by a transverse plane passing obliquely from the highest point of the withers through the upper part of the fore-arms, so as to afford a fair idea of the contours of the shoulders at their thickest parts. The direction of this plane is shown by the dotted line *a b* in Fig. 350. The width of the shoulders will attain its maximum measurement at about half way down, namely at *c*, on the same figure. The horses shown in Figs. 332 (well-shaped thorough-bred of the 11-stone hunter class), 329 (well-shaped 15-stone hunter), and 330 (thick-shouldered thorough-bred of the 13-stone hunter type), measured between the points of the shoulders (width across the breast), respectively, 15, 17 and 18 inches. These photographs have been done on nearly, though not quite the same scale. I think that the width between the fore legs is the best guide for judging the thickness (weight) of the shoulders of a riding horse, as for instance, the thorough-bred mare shown in Figs. 305 and 330. The bad impression conveyed, respecting her shoulders, by the former illustration is thoroughly confirmed by the latter.

Photo by] [CLARENCE HAILEY, NEWMARKET.

Fig. 346.—Captain Powell's Midshipmite.

Photo by] [M. H. H.

Fig. 347.—Straight-shouldered thorough-bred.

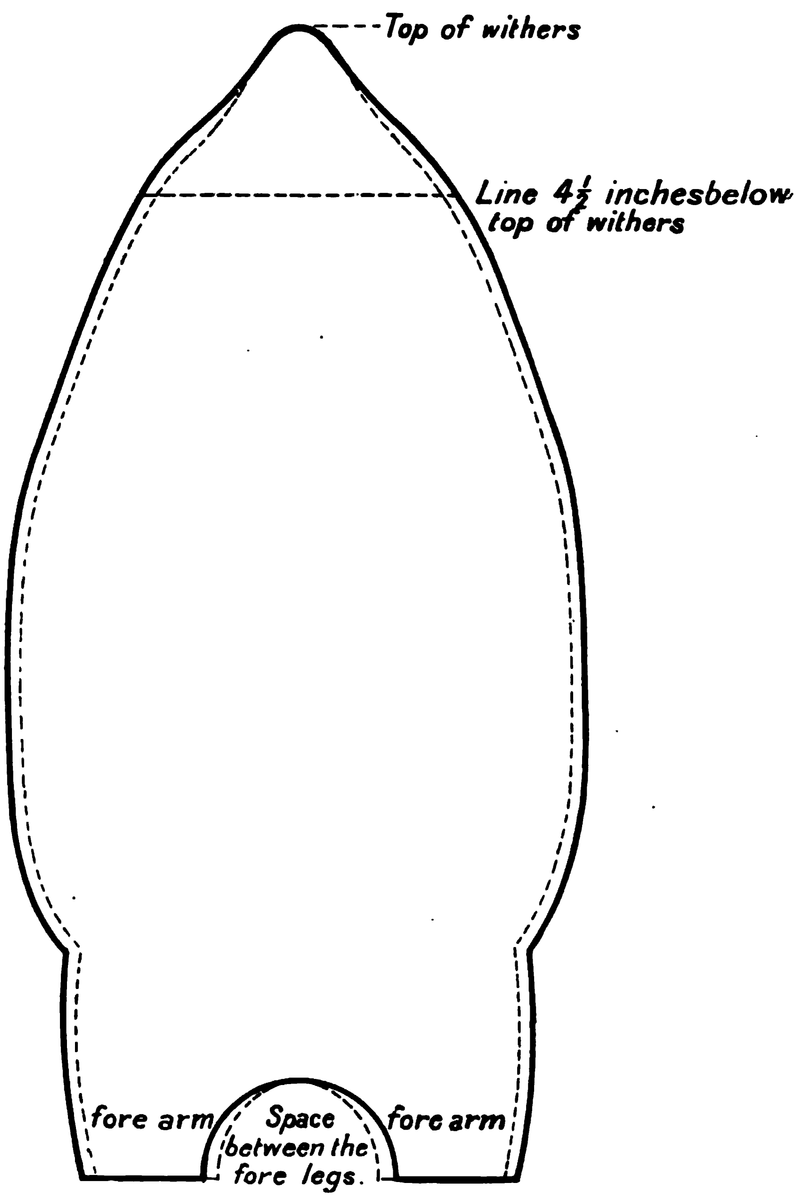

Fig. 348.

The full-sized figure bounded by a continued line represents a transverse section through the shoulders of a thorough-bred with thick withers, made by a plane passing through the highest point of the withers and fore-arms. The direction of this plane is shown in Fig. 350 by the dotted line *a b*. The figure which is bounded by dotted lines, and which is inside the figure just described, represents a similar section through the shoulders of an ordinary well-shaped thorough-bred.

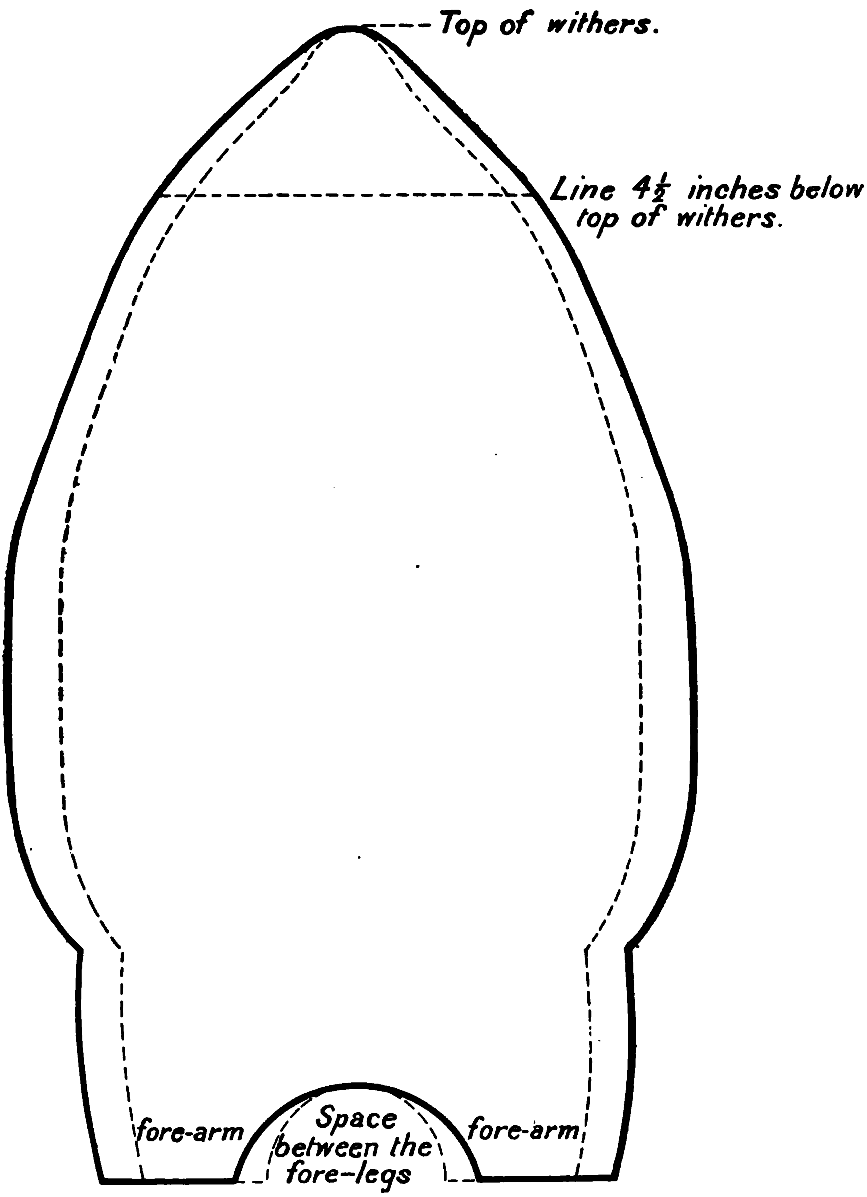

Fig. 349.

The figure bounded by a continued line (*see* descriptive letterpress of Fig. 348) represents a section through the shoulders of a thick-shouldered harness horse (Fig. 331); and the figure bounded by dotted lines and inside the larger figure, a section through the shoulders of a well-shaped 15 stone hunter (Fig. 329).

Length of shoulder-blade is a valuable "point" in all classes of horses. In the racer, considerable length of the muscles which open and close the angle made by the shoulder-blade and humerus, is conducive to speed. As the size of a bone is, as a rule, proportionate to the thickness of the muscles which are attached to it; the length of the shoulder-blade may generally be taken as a measure of the strength of the muscles which connect it with the trunk, and upon which the weight-bearing powers of the animal are mainly dependent. Hence, a large shoulder-blade is not only advantageous to the weight-carrier and heavy cart-horse; but it is also essential to the jumper, in order to enable him to bear the shock of landing over a fence with a man on his back. The dog, which has a short shoulder-blade, as compared to the horse and ass, is, as we might expect, a very bad weight-carrier. We may prove this practically by testing the respective strength of the back of a powerful mastiff weighing, say, ten stone, and that of a very small donkey, which, although he might not have as great draught power as the dog, would be able to carry far more weight.

The shoulders of the race-horse, as I have already indicated, should be long, oblique, and as light as is compatible with their work. As far as mere speed goes, great obliquity of shoulder appears to be no advantage. As the weight is brought more forward by the shoulders being upright, than if they were sloping, the former condition, by increasing the instability of the equilibrium (p. 69), is equally, or even perhaps more conducive to speed than the latter. It also, by tending to bring the humerus into a more horizontal position, places that bone in a more advantageous direction for forward propulsion, than it would have with an oblique shoulder; because the impetus given to the fore-hand in progression to the front, takes place through that bone. Those particularly speedy animals, antelope and deer, have comparatively straight shoulders. Many of our fastest race-horses have been built in this way. It is not, however, sufficient for a horse to have the great gift of speed, in order to shine on the turf; but he must also be able to "stand training," which will more or less severely test the durability of the bones, ligaments and tendons of the legs, and especially of his fore ones. Both in training and in racing, the animal has to carry a rider, whose weight will add materially to the "wear" of the fore legs, the jar on which will be far less when the

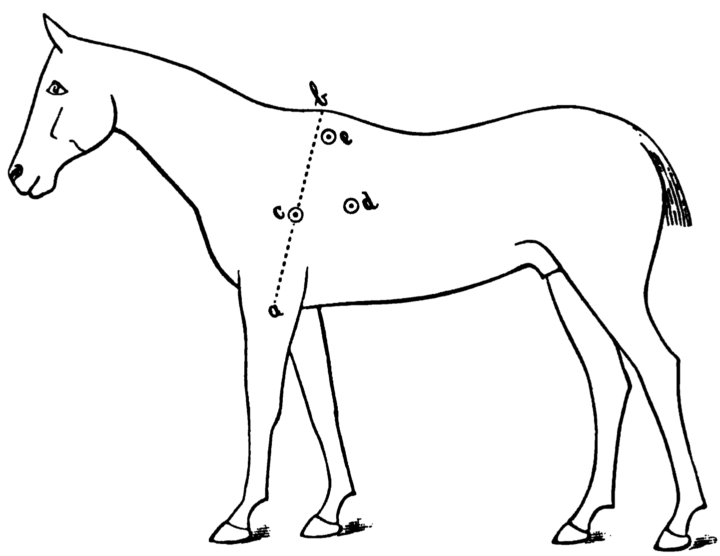

Fig. 350.—Diagram to explain Figs. 348 and 349.

shoulders are oblique, than when they are comparatively upright.

Important as obliquity of the shoulders is in the race-horse, it is not nearly so much so as lightness of that part; for heaviness of the fore-hand throws increased strain on the fore legs, and also detracts from speed. We have three simple and practical guides by which we may judge of the lightness or heaviness of the shoulders: (1) by the manner in which the neck runs into the shoulders. If we observe that there exists, at their point of union, a marked depression (p. 269), we may with reason conclude that the animal, being furnished with a good surface for the collar, was evolved for draught rather than for speed. Here we must not be led astray by the appearance of any undue thickness of the neck muscles which may fill up this dip; for the fact of their being massive would be even more prejudicial to the galloping pretensions of the horse, than if the shoulders were somewhat "loaded." As the neck projects beyond the fore legs; weight in it, by its increased leverage, will interfere with the action of the fore limbs to a proportionately greater degree than weight in the shoulders, which will be placed more or less above this bony and muscular spring, to which I have alluded in Chapter VIII. (2) By the comparative width between the fore legs, which has been discussed on page 243, *et seq*. (3) By the comparative "thinness" or "thickness" of the withers. As a rule, any undue thickness of the withers will be specially well noticed, by the rider, at a point on each side, as I have already said, about 4½ inches below the top of the withers. This is a peculiarity of shape with which every experienced hunting man must be familiar. A study of Figs. 348 and 349, which have been drawn from actual measurements, will further elucidate my meaning.

Special attention should be directed to the fact that obliquity and lightness of shoulders, by tending to render the animal's action perfect, are indispensable requisites for enabling him to "stay" over a distance of ground. I have seen many "sprinters" which have had upright and loaded shoulders; but I have never known a genuine stayer—like what Ormonde, St. Gatien, or Robert the Devil was—have that kind of conformation.

In the *shoulders of the draught-horse*, there should be plenty of power and a broad bearing surface for the collar, into which the animal should be able to put all his weight. It will be found that the deductions made on page 78 are, generally, in accordance with the experience of practical men like Mr. G. M. Sexton, Secretary of the English Cart-horse Society. He admires "the shoulder well let down into the chest, and with a moderate slope; it is not necessary to be too oblique, as with a hunter or a race-horse, but just sufficient to ensure free action of the fore legs, encased with plenty of muscle, which will enable him to lean into the collar . . . . It is essential that he should be a free, fast walker . . . . Action means power, time and money." Mr. F. Street, in *The History of the Shire Horse*, advocates, "Shoulders well thrown back." Mr. Thomas Dykes, late Secretary of the Clydesdale Horse Society, remarks in the Stud Book of that breed, that "the shoulder should be more oblique than in the English draught-horse. This, indeed, is one of the distinctive features of the Clydesdale, as his formation of shoulder is largely owing to his long, quick step, for which he is so justly admired. The upright shoulder of the English cart-horse may certainly give greater power in the collar, but if shortness and slowness of step be considered, this cannot be called an advantage. The English horse, besides, is more accustomed to sheer dragging and to working in chains, while his Scottish rival is chiefly employed in the two-wheeled cart, which occasions a considerable amount of weight being balanced on the animal's back. A medium slanted shoulder gives a horse, in such circumstances, an advantage; and doubtless those who carted the minerals of Lanarkshire in ante-railroad days, found this formation well adapted for their purpose. Even yet no one will affirm that it is unsuited to the traffic of the day, if he will only take the opportunity offered for forming an opinion by the sight of the Clydesdale horses yoked to cart or lorry in the streets of Glasgow." Mr. Reynolds, M.R.C.V.S., in his *Essay on the Breeding and Management of Draught-horses*, while recommending that the shoulders should be massive and well thrown outward to afford ample space for the collar, cautions his readers as follows against extreme views about oblique shoulders :—" Many good judges insist that a cart-horse should possess very sloping shoulders. Whilst admitting the necessity of such a conformation for good saddle and light harness horses, and appreciating its beauty in heavy animals, I am decidedly opposed to the opinion, on the ground that such a form is almost invariably associated with thin withers and shoulder-blades closely applied to the front ribs, affording an insufficient and insecure seat for the collar, and, consequently, one very defective for the purposes of heavy draught."

Horses—like the heavy draught animals of Edinburgh, Liverpool and Manchester—which have toe-pieces on their shoes, and which consequently make full use of their fore legs as propellers, should have fairly upright shoulders, and should have no bearing-reins, which would impede them in advancing and lowering their heads. Dray-horses, like those in London, which have flat shoes in front, should have sloping shoulders. If the ground, such as wood pavement or asphalte, be unsuitable to the use of toe-pieces, the animals, even if they have not to go out of a walk, should have oblique shoulders; because in this case, the fore legs will be concerned more in maintaining the stability of the body, than in propelling it. We may also infer that horses which have toe-pieces on their fore shoes, will do their work best when their shoulders are upright.

The *shoulders of the hack and light harness horse* ought to be oblique and light, in order to obtain sure-footedness, and sufficient knee action. The shoulders of the *match trotter* will be considered further on (p. 585).

The *shoulder-blades of the hunter and chaser*, as I have already said, should be long and oblique, so as to enable him, in the best possible manner, to resist the shock of landing over a fence. On account of having this special kind of work to do, his shoulders should be more muscular than those of the race-horse. The fact of his shoulders being sloping, will enable him to "take off" more "cleverly" at any obstacle than he could do, were they upright.

The term "good shoulders" or "bad shoulders" is nearly always a comparative one; for shoulders which would be very bad in one type of horse, might be very good in another type.

The Humerus.—The position and form of this bone, which lies between the shoulder joint and elbow, are so hidden by the muscles about it, that it is difficult to form a correct opinion as to its conformation. Even if it were exposed to view as much as is the fore-arm, I cannot see how the fact of its being so, would greatly help us. We know that forward propulsion given by the fore limb must take place through it; but we cannot exactly determine its best direction for purposes of progression. We are aware that the different paces of the horse require, in varying proportions, the direction of the propulsion to be both upward and forward; but we cannot tell what these proportions should be. It is evident that the heavy cart-horse, which requires all the aid he can obtain from his fore limbs to propel him forward, should not have an upright humerus. It appears probable that the angle which the shoulder-blade makes with the humerus, varies but little in different horses, in which case, the more oblique the shoulder-blade, the more upright the humerus; and *vice versâ*. Consequently, by observing the slope of the shoulder, we might estimate that of the humerus.

Elbow.—The point of the elbow should be capable of being drawn well away from the side. It will then have plenty of freedom, and will not be tied down to the chest.

Fore-Arm.—This part in all horses should be muscular; as its muscles have to do all the work of the limb below the elbow. On p. 188, I have alluded to its comparative length. In Figs. 275, 277, 322, 351, 369, and 404, are shown well-shaped fore-arms; in Figs. 363, 386, and 422, mean ones. Although a race-horse might have a somewhat light fore-arm without much detriment, it is imperative for the jumper to be strong in this part; for in leaping, great strain falls on the muscles at the back of the fore-arm in straightening the fetlock, by which action the fore-hand is raised. It is evident that the heavy cart-horse should have a powerful fore-arm.

Knee.—Looking at the knee in profile, while the horse bears weight on the leg, we should find that the cannon-bone and radius are nearly in a straight line. In reality they are not quite so in perfect specimens; but are united by a slightly undulating line of great beauty, the contour of which I am unable to lay down with mathematical accuracy. Figs. 304, 308, 342, 351, 369, 427 and 431 furnish us with good illustrations of well-set-on fore-arms, knees, and cannon-bones. Figs. 352 and 353 are examples of the condition known as "calf-knees," to which there is a slight tendency in Fig. 360. The opposite formation ("being over at the knees") is shown in Figs. 354 and 311, and to a lesser extent in Fig. 355. This condition is generally due to hard work; but may be congenital; for I have seen it in young and sound animals which had not been broken-in, and which had consequently done no work, beyond voluntary exercise in their paddock. Fig. 355 represents the fore legs of a sound four-year-old hunter which had done very little work, and whose pasterns were more sloping than usual. As a great rule, when a horse stands over at the knees from work (Fig. 311), he assumes this position with the object of allowing his pasterns to become abnormally upright, so as to relieve painful structures from pressure, in which case, these structures will naturally be those that support (prevent undue extension of) the fetlock joint, namely, the suspensory ligament, flexor tendons and check ligament.

We are indebted to Mr. R. C. Irving, F.R.C.V.S., for explaining that congenital "standing over at the knees" is due to deficient development of the muscles which straighten the knee (*extensor metacarpi magnus* and *extensor metacarpi obliquus vel parvus*), and which are on

Photo by] [M. H. H.

Fig. 351.—Mrs. Hayes's Salary.

the front of the fore-arm. This relatively poor development of the muscles on the front of the fore-arm is well shown in Fig. 422. It is possibly caused by a portion of the contractile tissue being replaced by fibrous tissue, in which case, the contractile power and volume of the muscles in question would be diminished.

The fact of a horse being "calf-kneed" renders the back tendons and check ligaments more liable to sprain by violent descent of the fetlock, than if the knee were straight. It tends, however, to make the animal more sure-footed, by bringing the weight back from the toe. In all cases, this condition adds to the tension to which the back tendons are put when they are flexing the foot. Although it is in no way an advantage; it is much less a detriment to the cart-horse, which has rarely to go out of a walk or slow trot, than to the saddle-horse or fast trapper. Many heavy cart-horses are "back at the knees" (Fig. 274), which is not an uncommon shape of the fore limbs among Arab and East Indian horses.

As the bones of the knee give attachment to important tendons and ligaments, and as other important tendons, respectively, pass over the front and rear aspects of that joint; it is a beauty, recognised by all good judges, for a horse to have broad, large knees, as viewed from the front. The front surface of the knee should also be flat (Fig. 356); for any prominence of the part, as in the case of a "big" knee, will point to the probability of unsoundness.

From Knee to Fetlock.—We know from experience that the more nearly parallel the back tendons are to the cannon-bone—other things being equal—the better able will the limb be to stand work. Why this should be the case I cannot say with certainty. I may, however, hazard the conjecture that, as "tying-in" below the knee is due to the smallness of the bones which form the groove through which the back tendons pass, this condition may point to want of size in these tendons; for "the function makes the organ." It appears that the calibre of this groove (or rather canal), which, to a great extent, is formed by the pisiform bone, is, as a rule, ample for the working of these tendons; for when such "tied-in" tendons happen to become damaged by work, the seat of injury is very rarely behind the knee. Hence I think we may conclude that when this groove—which is dependent for its size on that of the bones behind the knee—is comparatively small, the tendons are also proportionately

Photo by] [M. H. H.
Fig. 352.—Calf knees.

Photo by] [M. H. H.
Fig. 353.—Calf knees.

Photo by] [JAMES HAYES.
Fig. 354.—Over at the knees.

Photo by] [M. H. H.
Fig. 355.— Slightly over at the knees.

wanting in substance, and consequently unduly weak. I have always remarked that, in legs of about the same size of cannon-bone, when the back tendons approached a direction parallel to the cannon-bone (as in Figs. 356 to 362, and 369), they were larger and consequently stronger than those which were tied-in (as in Figs. 365 and 366). The parallelism of the back tendons with the cannon-bone is beautifully shown in Fig. 362, which represents the fore legs of a thorough-bred yearling filly. We should regard a large degree of backward projection in the pisiform as a desirable "point"; not merely as indicating the size of the bone itself, but also that of the other bones of the knee. The pisiform is well developed in Figs. 356, 357, 358, 360, 361, 362, and many of the other photographs in this book; and poorly, in Fig. 364.

The objectionable tying-in of the knee, which we may see in Figs. 365, 366, and 367, is I believe, due in almost all cases to an admixture of more or less cart blood. Although individuals of other breeds may be light below the knee, I have never seen in them this fault emphasised by undue width of pastern (from front to rear), in the same manner as it is in many of our draught-horses. It is not present in the particularly good legs of the cart mare shown in Fig. 369. Experience tells us that a leg which shows the form of tying-in below the knee to which I allude, is altogether unfit for fast work, or for jumping, and is unobjectionable only for labour which does not require the animal to go quicker than a slow trot. The reason for this is, as far as I can see, that a large fetlock is characteristic of cart blood, and consequently indicates that the bones of the part are unfitted for work at fast paces. During the evolution of the horse, the size of his fetlock has diminished by the disappearance of the digits of his present splint bones. Hence, it is reasonable to suppose that a horse with relatively large fetlocks is of an older type than one whose

Photo by] [M. H. H.

Fig. 356.—Good fore legs and sloping pasterns of Arab pony.

Photo by] [M. H. H.

Fig. 357.—Good fore legs of hunter.

Photo by] [M. H. H.

Fig. 358.—Good fore legs of steeple-chase horse.

Photo by] [M. H. H.

Fig. 359.—Good fore legs of cart horse.

or any fulness or softness, will indicate the presence or previous existence in them of injury or disease. If the leg be free from an excess of hair, the suspensory ligament should stand out in bold relief (Fig. 360) between the cannon-bone and back tendons, and should feel as tense and hard as a fiddle-string. If there be any difficulty in tracing its course with the fingers, or if it feels soft or rounded, we may rest assured that it has suffered from

Photo by] [M. H. H.
Fig. 364.—Small development of pisiform bone.

injury, which fact will probably prevent it from standing much work. In "clean" legs (Fig. 360), we should be able to trace the course of the suspensory ligament for some distance on each side, as it proceeds obliquely down the pastern.

Fetlock.—The chief points about this joint are: that it should be flat from side to side, and that, viewing the leg in profile, it should not (as I have previously remarked) be broad as compared to the width of the leg just below the knee (Fig. 366). Any roundness of the fetlock which

Photo by] [M. H. H.
Fig. 365.—Tied-in below the knee.

Photo by] [M. H. H.
Fig. 366.—Tied-in below the knee, and large fetlocks.

Photo by] [M. H. H.
Fig. 367.—Tied-in below the knee, and large fetlocks.

Photo by] [M. H. H.
Fig. 368.—Bones of pastern too slight.

is caused by undue thickness from side to side of this part, will indicate the effects of "work," or of injury. The peculiar roundness of fetlock, produced by sprain of the suspensory ligament at its attachment to the sesamoid bones, can be readily noticed by a capable observer.

At the back of the fetlock there is a lock of hair which gives its name ("feet-lock") to that joint, and which is particularly abundant in cart-horses. This tuft of hair covers a fatty mass (the fetlock pad), and generally has in its centre a horny growth, called the *ergot* (p. 319).

Pastern.—By the working of the fetlock and pastern joints, the injurious effects, on the limbs, of concussion are more or less obviated, and assistance is given in the straightening of the limb, to raise the fore-hand. As a horse will have no difficulty, under ordinary conditions of soundness and labour, in bringing his pastern into the same straight line as his cannon-bone; the amount of "play" which the fetlock has, will depend on the distance through which the fetlock can descend, or, in other words, on the acuteness of the angle which the pastern can make with the ground, when weight is thrown on the part. Although we cannot, by mere inspection of the animal, determine the efficient limit of this angle, we may assume that horses which have, when standing, what are called sloping pasterns (Fig. 356), will have more play in these joints than those that have upright pasterns. On the other hand, their back-tendons and suspensory ligaments will work at a greater mechanical disadvantage. As the expressions "oblique (or sloping) pasterns," and "upright pasterns," are more comparative than absolute, it is impossible to define them with precision. Figs. 356 and 353 may be taken as good examples of these respective forms of conformation. We all know that pasterns which would be far too upright for fast work on hard ground, might do admirably on soft ground or for slow draught. Although the pasterns of the fore legs, shown in Fig. 353, appear very upright; they belonged to a horse which galloped in good style, and jumped (Figs. 224 to 228) with great cleverness and "flippancy," on all kinds of ground. The abnormal uprightness of his pasterns when he was standing, in no way prevented his fetlock and pastern joints from having free play during movement. The obvious lesson, here, is that shape should not be studied independently of action.

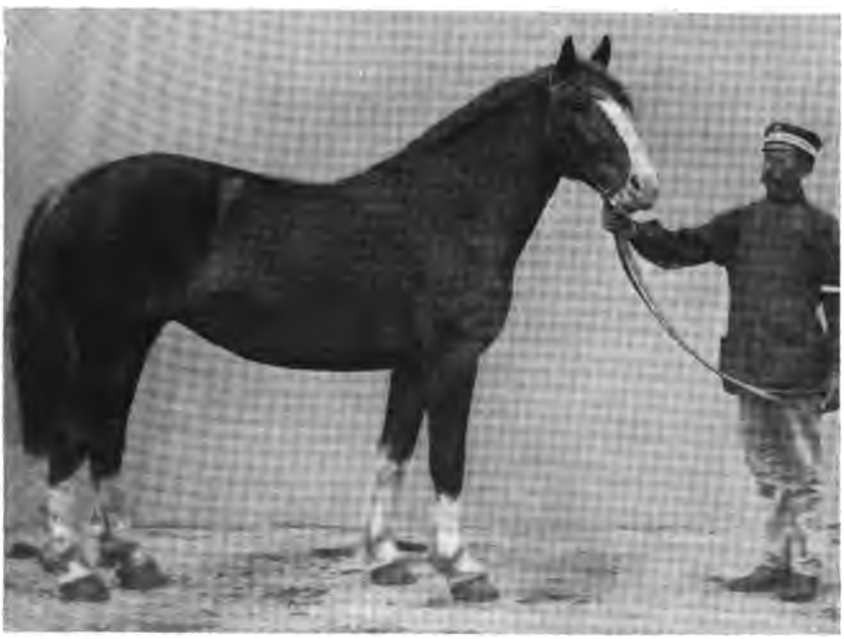

Photo by] [F. ALBERT SCHWARZ, BERLIN.

Fig. 369.—Schleswig cart mare, Hansa. (17 hands high.)

We may accept, as an axiom, the statement that the harder the ground and the faster the work, the more sloping should the pasterns be, in order to save the legs from the injurious effects of concussion (p. 73). If the horse be required to gallop over hard ground, the pasterns can hardly be too oblique (supposing, of course, that this condition has not been brought on by injury); provided always that the pastern bones are strong. Fig. 356 shows an extreme case of sloping pasterns in an Arab pony that had remarkably sound legs. Such instances are in no way uncommon among the Sons of the Desert; and as a rule, the possessors of pasterns of this kind are animals which like to "hear their feet rattle." Mr. Covey's famous Arab, Marquis, who won all over India, at all weights and distances (in his own class), showed this peculiarity in an admirable manner. After doing as much work as would break down a dozen ordinary horses, his legs were as clean as when he was foaled; although, even when walking, his fetlocks came nearly down to the ground at each step—so oblique were his pasterns, the bones of which, though long and sloping, were of good substance. My experience among horses in many lands, leads me to the conclusion that the drier the country in which they are bred and reared, the more sloping are their pasterns. I advance no theory in support of this instance of the "survival of the fittest," which I give merely for what it is worth. Australian horses have their pasterns more oblique than English horses (though they are practically of the same blood), and are consequently better fitted for work on hard ground. As the shoulder-blade and pastern are at the opposite ends of the spring made by the bones of the fore limb, we may infer that they should be more or less at the same slope. Hence, if it be desirable that a horse should have oblique shoulders, he should also have well-sloped pasterns, which is a term that had best be accepted as indicating a condition of limb, in which the fetlock and pastern joints have free play.

Two curses which remain in English thorough-breds are upright pasterns and roaring. The former condition is such a common defect that it generally passes without notice, and is accepted by the ignorant as the proper kind of conformation. Of the two, I certainly think that undue straightness of pastern is the cause of the turf career of more English horses being cut short, than is roaring. Examples of this fatal shape are very common.

The defect of uprightness of pastern in the fore limb (want of "play" in the joints of the fetlock and pastern) not only militates against the speed of a horse by causing him to suffer to an undue extent from the injurious effects of concussion; but also tends to decrease his power of raising his fore-hand by the straightening of the fore limb, as we see done by the horse in Figs. 184 to 189. It is

Photo by] [M. H. H.

Fig. 370.—Heavily topped hunter.

evident that if the fetlock and pastern joints possess but little mobility, there will be only a slight descent of the fetlock joint, and consequently their "play" will affect but little the length of the limb. We have seen (p. 61) that propulsion is accomplished by the straightening out of the limb, to effectually do which, the joints in question must possess the ability to be freely flexed and extended. Every experienced trainer will have noticed that as a race-horse's fore pasterns become more and more upright from work, the more will he lose his speed and his "level" style of galloping. This will also occur to a horse whose pasterns have become abnormally oblique on account of sprain of the suspensory ligament, in which case the defect will lie in the inability to straighten the joint freely when weight is thrown on the limb. Also, the longer the pastern, the greater will be the play of the fetlock joint. Hence, length, as well as obliquity, of pastern is an indication of speed.

Polo has done much to teach men in England the necessity of sloping pasterns for work on hard ground.

Lecoq remarks that: "The direction of the pastern is almost always influenced by its length. The shorter the pastern, the more upright is it; and the longer it is, the more is it sloped." This rule may hold good in horses of the same class; but not, at least to the same extent, among animals of different breeds. This French writer also adds with justice that: "There are, however, horses —and especially mules and asses—in which the pastern, although very short, is well sloped." As the evil effects of concussion fall much more severely on the fore limb than on the hind leg, its pastern is, normally, more sloping.

Referring to Clydesdales, Mr. Dykes writes: "No doubt the upright pastern suits well the upright shoulder and slow action of the English draught-horse, a conformation which can scarcely be called the best for any purpose; but it will not do in the Clydesdale, which requires a pastern to suit the formation of the shoulder, and to confer the necessary elasticity to counteract the concussion caused by his quick, firm step. Short upright pasterns always get worse with age and feeding, and the action in due course of time becomes impeded. A horse with an upright pastern has little or no command of his foot, and literally walks as on a crutch; and if he has no power of his foot, he cannot have much in his shoulder. The streets of Glasgow are very trying to horses which have to scramble for a footing in the furrows between the hard, smooth paving stones; and horses with upright pasterns are sometimes almost powerless to move, where those with pasterns moderately sloped, and of medium length, can walk with comparative ease. Farmers around Glasgow are alive to this, and will not readily use a stallion which has this defect, however strong and shapely."

On page 268, the connection between the action of the shoulder and that of the pastern has been discussed.

The direction of the fore pasterns is an important point in equine conformation, especially as horses, unlike ourselves, have but little power of rotating their fore limbs. For ordinary work, and particularly as regards soundness, the direction of the fore pasterns should be parallel to that of the body, as in Fig. 55. In the majority of cases, any turning-out (Fig. 57) or turning-in (Fig. 56) of the toes of the fore legs is due to the bones below the fetlock (not those above that joint) being in an abnormal direction (twisted outwards or inwards). Experience teaches us that the defect of turning-in the toes, which is seldom met with, except in heavy horses, decreases the speed, and is often accompanied by injury of the fetlock joint, as we can see in Fig. 56. Turning-out the toes is a frequent malformation in East Indian horses which have light bodies and long legs, and is a characteristic of American trotters of the present day. It occasionally occurs in race-horses and hunters. Its great fault is its well-marked tendency to cause the horse to "hit" himself, the bad effects of which habit can be more or less obviated by the employment of "boots."

The increasing frequency of turned-out toes in American trotters which are persistently "bred to the winner," strongly suggests the conclusion that this peculiarity is an inherited aid to trotting speed. In order to obtain a mathematical proof of its advantage as regards speed, let us suppose that the parallelogram in Figs. 371 and 372 represents the plan of the body of a horse which, while trotting, keeps his body in a position nearly similar to that which it occupies when he is standing; and that he is propelling himself forward by his left diagonal (near fore and off hind) in Fig. 371, and by his right diagonal (off fore and near hind) in Fig. 372. In this case, he will sustain a considerable loss in forward movement, by lateral deviation; because the propelling power of the hind limb is much greater than that of the fore leg. Therefore, to obtain the

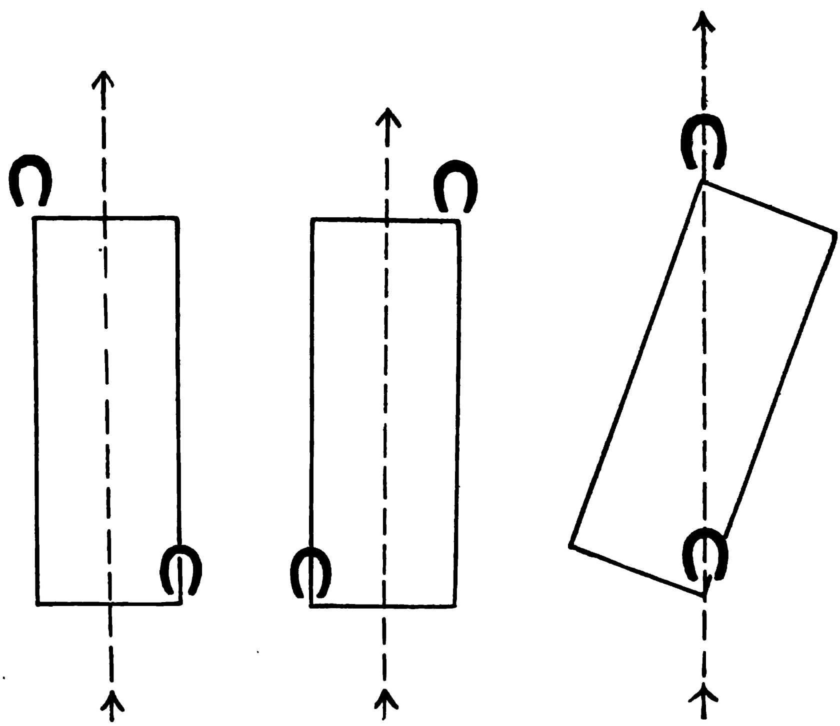

Fig. 371. Fig. 372. Fig. 373.

highest possible speed at the trot, it is necessary that the respective imprints of the fore and hind feet should be in the line of progression, as in Figs. 373 and 374, in which case the fore feet will be turned out, and the hind ones turned in. If the respective directions of the fore and hind feet are parallel to the direction of the body, there will be an evident loss of power. Thus, the proportion between the forward propulsion in Fig. 373 and that in

Fig. 375 will be as the length of *a b* is to that of *a c*. Or, if we term the forward propulsion in Fig. 373, P, and that in Fig. 375, P^1, we shall have $P^1 = P \times \frac{ac}{ab}$.

In this question, we need take into account only the direction of the fore pasterns, because the mechanical construction of the joints of the stifle and hock causes the hind

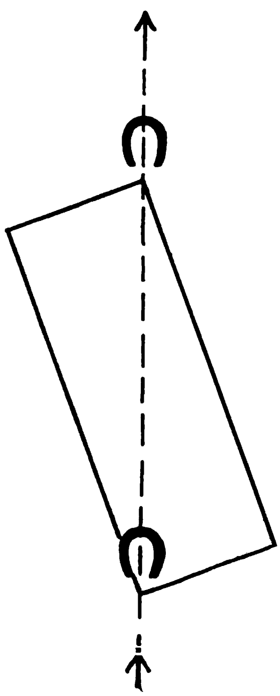

Fig. 374.

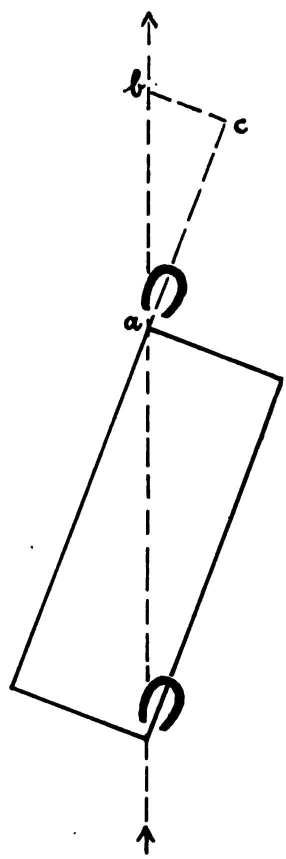

Fig. 375.

toe to be more or less rotated inwards during forward propulsion. On page 140 I have alluded to the well known fact that the faster a horse either trots or gallops, the more do the imprints of all his feet tend to come into one straight line, namely, that of forward progression; and the same remark applies to human sprinters and fast walkers.

The Hoof corresponds to the nail of our third finger. or toe, or to the claw of the third toe of the dog. The frog is a horny accessory structure to the hoof, and is placed immediately behind the sole. As pointed out to me by Professor Ewart, the sole corresponds to the palmar surface of the third phalanx of the middle finger of man; and the frog, to the palmar surface of the second phalanx.

Photo by] [M. H. H.
Fig. 376.—Horizontal section through donkey's near hind hoof.

This is well shown by the fact that the horse's frog is formed out of a pad which, in the eight weeks' embryo, lies under the short pastern bone (2nd phalanx). In the horse, it is so closely connected with the hoof, that it is usually regarded as a portion of the hoof. This connection is not so close in the donkey, as we may see in Fig. 376. In the horse, it acts as a buffer (pad), to diminish the bad effects of concussion during movement.

The horn of the wall, sole, and frog should be thick, hard and tough, so as to resist in an efficient manner the effects of wear. Moisture has a well-marked softening and weakening influence on the horn, and it consequently affects the form of the foot. We find that the drier the climate, the stronger is the horn of horses reared in it ; the more upright are the hoofs ; and the more

Fig. 377.—Rear view of unshod off hind hoof (⅔rds nat. size).

concave are the soles. When the horn of the wall and sole is weak, it cannot efficiently support the weight thrown on the leg, and the foot will have a tendency to become flat. The feet of horses bred in Australia, for instance, are stronger than those produced in England, owing to the climate being drier. We know from experience, that moisture has probably a great influence in quickening the growth of horn, as we may see in horses turned out on marshy ground. Also, in those parts of India where the yearly rain-fall, though large in quantity, is practically confined to about four consecutive months, it is found that the growth of the horses' feet during the "monsoons" is much greater than it is in the dry weather. Hence, we may be right in concluding that this stimulation in growth is one of length of horn, and not one of increased horny material. The increased growth of the hoof during the monsoons may, however, be due to the fact that this growth is more rapid during the spring, which is the monsoon time, than at other periods of the year. The great trouble with heavy cart-horses in England is the weakness of their hoofs, the horn of which, as a rule, is not nearly so strong as that of well-bred horses; although the strain which falls on it is much greater than that which tries the tenacity of the horn of the feet of saddle horses. Considering the greater size of the muscles and bones of the draught animal, we might expect that the horn of his hoofs would be proportionately stronger than that of the half-bred. The fact that it is not stronger, is a proof that English cart-horses are deficient in one of the most important points of usefulness. Veterinary surgeons in practice in England and Scotland can tell us that the large majority (I would say about nine-tenths) of cart-horses which come to them for treatment, are foot cases. The ideal hoof of a cart-horse should in no way differ from that which is most suitable to a light trapper, hunter, or race-horse, except that it should be larger and consequently stronger. Therefore, weak feet, with low, spread-out heels and flat soles, have become far too generally accepted as characteristics of cart-horses. Small contracted feet are equally bad.

The inner side of the foot is more upright than the outer side (Fig. 377), and the inner side of its ground surface is straighter (Fig. 382); conditions which provide for more weight falling, on the inner than on the outer side of the foot. Sometimes, as in Fig. 383, there is very little difference between the inner and outer portions of

Fig. 378.—Fore foot of unshod well-bred horse (⅔rds nat. size).

Fig. 379.—Hind foot of unshod well-bred horse (⅔rds nat. size).

the surface of a horse's foot. The horn is thickest at the toe (at which part there is the greatest amount of wear from friction with the ground), and gradually gets thinner as it approaches the heels.

From many careful measurements, I have come to the conclusion that the slope of a well-formed fore foot, at the toe, will vary from about 47° (Fig. 380) to 57° (Fig. 378); and that of a well-formed hind foot, from about 53° (Fig. 381) to 63° (Fig. 379).

As the hind limb is concerned more in propulsion than in resisting the evil effects of concussion; its pastern and hoof should be more upright, than that of the fore leg. The hind hoof, as compared to its length, is generally narrower; the ground surfaces of its quarters are straighter, and their respective curvatures differ less from each other, than those of the fore extremity. The horn at the toe is not so thick; and the sole is more concave. Especially, in shod horses, the frog is narrower and less developed; and the heels are higher and closer together, than in the fore foot.

The slope of the hoof will conform somewhat to that of the pastern. The outside surface of the hoof should be naturally smooth, and should be straight from the coronet to the ground; because undue roughness, bulging-out, or concavity of surface will indicate the probable presence or previous existence of disease. The heels should be strong and the "bars" well developed, so that the proper slope of the foot may be maintained, and that the liability to "corns" or to contraction of the heels, may be lessened. One effect of shoeing is to cause the heels to be subjected to more wear than the toes; for, at the latter part, the position of the iron with regard to the wall is fixed; but at the former there is a certain amount of "play" between the shoe and the horn. Consequently, the tendency of the shod foot will be to acquire a less slope than it ought to have at the toe. This difficulty in preserving the proper shape of the hoof is a troublesome one to every careful and competent shoeing smith.

Some horses have such weak heels, that if they wear ordinary shoes, it is impossible to keep the feet at a

Photo by] [M. H. H.

Fig. 380.—Fore foot of unshod cart-horse (⅔rds nat. size).

Photo by] [James Hayes.

Fig. 381.—Hind foot of unshod cart-horse (⅔rds nat. size).

proper slope, or to prevent them getting corns. The fact of the feet being at a less slope than natural, will cause an undue amount of strain to be thrown on the back-tendons (p. 73). If the bars be weak in comparison to the wall, or if they be cut away, the heels of the shod foot will have a tendency to contract. Unusual width between the heels is generally associated

Fig. 382.—Off fore foot of unshod horse ($\frac{2}{3}$rds nat. size).

with weakness of those parts. At the same time, they should have no tendency to contraction, which will not be present if the frog, as it ought to be, is well developed. An unusually large size of frog points to the effects of laminitis (fever of the feet), provided that the sole is convex, or even flat; but if the sole is concave, there need be no fear that the frog is too big. Horses which have never been shod, have their frogs much larger, their heels farther apart, and the ground surface of their feet of greater area, than those which habitually stand on iron. The cleft of the frog of a healthy foot

Fig. 383.—Near hind foot of unshod horse (⅔rds nat. size).

(Figs. 382 and 383) is merely a slight depression in the centre of the frog, and does not communicate with the sensitive structures immediately above the frog. If the wall be strong and the sole be concave, we may rest assured that the horn which covers the sole is of sufficient substance, provided, of course, that it has not been pared away by the shoeing smith. Some horses have an excess of soft tissue at the back of the foot, which then makes the distance between the coronet and heels abnormally long. This condition is known as "boxy" or "fleshy heels," and is objectionable, in that it cramps the action of the foot, and renders it weaker, and consequently more liable to injury, than if the foot were in a normal state.

An undesirable kind of conformation which is sometimes seen, usually in horses that have a combination of cart and thorough-bred blood, is that which gives the hoof the appearance of being too big for the bones which it covers (Fig. 368), without being in any way deformed by disease, or by an overgrowth of horn. This condition is due to the pastern bones being slight in comparison to the size of the pedal bone, which, in health, regulates that of the hoof. In such cases, the leg is not only abnormally weak, but the fact that its bones are not symmetrical, points to the probability that there are, in other parts of the framework, similar instances of lack of harmonious conformation.

CHAPTER XIX.

THE HIND LIMB.

General View of the Hind Limb—The Pelvis—Thigh and Stifle—Tibia—Hock—Shank and Fetlock—Pastern and Hoof—Callosities on the Limbs.

As many points of resemblance exist between the fore and hind limb, I shall assume, in order to avoid needless repetition, that my readers, before arriving at this chapter, have studied the preceding one, and also Chapter VIII., in which I have tried to explain the action of both pairs of legs.

General View of the Hind Limb.—I have included the pelvis among the bones of the hind leg, solely from a conformation point of view, and not from an anatomical one. Although the chief function of the hind limb is that of propulsion, it has, like the fore extremity, to bear weight, but to a lesser extent, and is also less exposed to the effects of concussion. Thus we see that while the shoulder-blade is connected to the body by muscles which work like a spring, in order to save the parts from the ill effects of concussion; the pelvis is firmly united to the spine, and consequently the force of propulsion by the hind limbs is transmitted to the body with but little mechanical loss. The pastern and hoof of the hind-quarters are more upright than those of the fore-hand, and, consequently, the muscles which flex their fetlock and pastern joints act to greater mechanical advantage.

We have seen in Chapter VIII., that for the attainment of high speed, the horse should possess the fullest ability to bend and extend the hind limb. Hence the beauty, in the race-horse, of a "straight dropped" hind leg. As this power chiefly depends on the action of the hock, its further consideration will be deferred, until that joint is specially discussed (p. 313.)

On pages 189 and 190, we have seen that the desirable proportions of the bones of the limbs are: pelvis, long; thigh, short; tibia (from stifle to hock), long; cannon-bone, short; and pastern, long.

The sets of muscles which move the joints of the hind limb, appear to complete their respective actions, in succession, from above downwards, namely: the hip-joint first; then the stifle; and, finally, the hock and fetlock; the former being extended by the muscle which bends the latter. We may infer that, to be effective in the production of speed, these actions must increase in rapidity in the same order. As the muscles that "start" the weight at each step are those which extend the hip-joint, we must look for, in the cart-horse, special muscular development of the croup and thigh. In the race-horse, however, length and power of the muscles of the gaskin, which cause acceleration of speed at the end of the "stroke," should be particularly sought for. These deductions are in accordance with the nature of the conformation respectively exhibited by horses which are representative types of these two classes.

The Pelvis.—The principles discussed in Chapter I., regarding the respective working capacities of long and thin muscles, and short and thick muscles, prove, that for speed we require the pelvis to be narrow, when viewed from behind (Fig. 384); and for strength, broad (Fig. 335). The pelvis of the weight-carrying hunter (Fig. 385) may be regarded as an intermediate form.

If we examine Fig. 129, and refer to Chapter IX., we shall see that the push, in draught, by the hind leg, is in an irregular line from the toe, through the bones of the hind limb, the pelvis, and the body, to the centre of pressure of the collar on the shoulder. In Fig. 182, the line of propulsion is similar to that in heavy draught, except that it passes through the centre of gravity, instead of the centre of pressure on the shoulder by the collar. It is evident

Photo by] [DIXON & SONS.
Fig. 384.—Rear view of Ormonde.

Photo by] [M. H. H.
Fig. 385.—Rear view of well-shaped 15 stone hunter (Fig. 322).

that the straighter this irregular line is, the more effective will be the propulsion. In draught, therefore, shortness of the hind limbs, as compared to the fore-hand, will be an advantage, in that it will tend to render the line of bones through which propulsion takes place, straight. As good length of hind limb is a necessity in the galloper; any reduction in the convexity of this line will have to be obtained by the opening out of its angles, and not by curtailing the length of the hind limb. Thus, the hind leg will be stretched out as much as possible to the rear (compare Figs. 129 and 182), and the direction of the pelvis (as a point of conformation) will be more horizontal than in the draught animal. A "horizontal croup" is a great beauty in the saddle horse, and is also a decided mark of speed. If the pelvis or croup (which in this case is practically the same thing) be too level (pp. 254 and 255), we may suspect that the back is weak.

It is evident that the pelvis is more upright when the animal is standing still, than when he is in movement; and when he has no burden on his back, than when he is mounted.

In jumping, the conditions are different from those of galloping or draught; for special provision has to be made in the leap for raising the fore-hand, when the horse "takes off." If we refer to Fig. 224, we shall see that the more a horse, at that moment, gets his hind legs under him, the easier will it be for him to raise his fore-hand. The more upright is the position of the pelvis, the more will the hip joints be lowered and brought forward. Hence a "goose-rumped" horse will be able to get his hind legs more under him, than if his pelvis were more or less horizontal. The correctness of this theory is borne out by the fact that in Ireland, hunting men like a hunter to have a drooping pelvis; because, so they say, this shape is generally associated with cleverness in jumping. Although high-class chasers generally have the pelvis fairly sloped; they are rarely goose-rumped, with an exception now and then, like Soarer, who won the Grand National in 1896.

A horse with unusually drooping quarters, as in Fig. 333, is said to be "goose-rumped."

I am indebted to Professor Ewart for pointing out to me that the zebra, whose natural enemy is the lion, has extraordinary power of rapidly wheeling round (making a "right" or "left-about turn") when he meets his feline foe, and is then able to gallop off in the opposite direction. If we examine Figs. 301 and 310, we shall see that, under natural conditions, a zebra stands with his hind legs much more "under" him, than a horse does; the chief reason evidently being that his pelvis is more upright. Also, if we inspect both ends of a zebra, we cannot fail to see that he is relatively broad behind and narrow in front, and that he has powerful loin muscles. Hence, his conformation is admirably suited to the performance of his defensive rotatory movement.

From a galloping point of view, a drooping pelvis is a serious defect; for its existence implies that the backward sweep of the hind leg is proportionately curtailed, and consequently the compass of the stride is more or less cramped. Also, on account of the point of the buttock being depressed, the muscles (the *ischio tibial*) which are attached to it and to the head of the tibia, and which aid in the extension of the hip-joint, will be unduly shortened in length. To have the point of the buttock placed high and projecting well to the rear is a great beauty, which may be seen in some thorough-breds and in high-caste Arabs. This kind of conformation is well marked in the hare, in which animal the pelvis is more or less horizontally placed; and the part of it (the *ischium*) that is behind the cavity in which the head of the hip-bone works, is much longer in proportion to the remainder of the pelvis, than it is in the horse.

The prominence which some horses show in the middle of the croup (Fig. 279), is due to the large development of the inner angle (*posterior iliac spine*, Fig. 18) of the pelvis (at each side), and points to the presence, in the part, of strong muscles. Cloister (Frontispiece) and St. Gatien had this prominence well marked. This peculiarity indicates great length of pelvis, which is a very desirable point in the hunter and chaser, in both of which, as we have already seen (p. 274), a long shoulder-blade is essential.

Thigh and Stifle.—The muscles of the thigh should be well developed, so that, when viewed from the rear (Fig. 385), they should leave no unsightly gap between the legs. For speed, the thigh should be comparatively short (p. 189), in which case the stifle will have the appearance of being placed high up on the flank. The stifle should be directed well outwards, so that it will have no difficulty in clearing the abdomen, which the peculiar construction of the hock joint that is explained on p. 74, enables it to do. It seems probable that the fact of some "cow-hocked" (hocks turned in, p. 313) horses being able to show an unexpected turn of speed, is frequently due to this kind of conformation conferring on them increased ability to bring their hind feet well forward.

Tibia.—Under this term, are included the muscles and tendons between the stifle and point of the hock, with their coverings, as well as the tibia (Fig. 18), which is the bone that lies between the stifle and hock joint. For speed, the tibia should have a maximum of length (p. 190). It is relatively long in the hare.

The *Gaskin* is one of the most important points by which we may judge of the suitability of a horse for fast work, for I venture to submit, after a long and careful study of the subject, that it is impossible for a horse to have a really fine turn of speed, unless he has broad gaskins; width of gaskin being conferred by length of *os calcis* (Fig. 18). We may see from Fig. 47, that the longer the *os calcis*, the greater is the mechanical advantage at which the muscles that are attached to the point of the hock, work. These muscles agree in length with the tibia, and the longer they are, the quicker will be the action of the hock in propulsion. The gaskin should be broad, for purposes of speed; and in all cases its muscles should be well developed (Frontispiece and Figs. 277, 387 to 391, and 404). In Fig. 386, the gaskin is poor.

The Hock.—On page 82, the direction which the hock should have, as viewed from behind, has been noted. We have seen on page 74, that by a special arrangement of the bones of the hock, the stifle is enabled to clear the abdomen, without altering the direction of the hind foot, when the hind leg is brought forward during movement. This action is

Photo by] [M. H. H.

Fig. 386.—Upright shoulders and poor gaskins.

facilitated by the fact that, in a normally shaped leg, the hock is directed slightly outwards as well as forwards. When the points of the hocks are turned in to excess (Fig. 58), the effect on the eye is bad; but the mechanical loss is small, unless, indeed, the fault be much exaggerated. If, on the contrary, the points of the hocks be turned outwards, the forward reach of the hind legs will be impeded by the abdomen. Also, if we observe, from behind, a horse which has this kind of conformation, and which is walking, we shall as a rule find that each hock, instead of moving steadily in a straight line, receives a peculiar twist (which must be accompanied by loss of power) while it is propelling the body forward. Experience certainly teaches us that, of the two defects, it is better for a horse to have his hocks turned in, than to have them turned out.

For purposes of speed, the hock should possess the power of being fully extended (p. 66); hence the beauty of a "straight dropped" hind leg. In all great gallopers (Ormonde, St. Simon, Favonius and Persimmon, for instance) we may see this kind of conformation; although it is true that some fairly speedy horses (but not of the highest class) have their hocks more bent than the types I have given. Ability to straighten the hock is not required, to any great degree, in animals that are used at slow paces. "Sickle-hocks" (Fig. 394), as those are termed which remain bent to a marked degree, when the joint is extended as much as possible, are, however, objectionable in any kind of horse.

While recognising the desirability of straight hocks for speed, we must not forget that this kind of conformation, to be effective, must be accompanied by good length of hind limb from hip-joint to foot, in order to obtain full advantage from flexion and extension. If the hind leg be comparatively short and the hock straight, as in Fig. 333, it is evident that there will be but little straightening out of the limb, when the "shove-off" is being given.

The width of the leg, immediately below the hock (looking at the limb in profile), should be as great as possible compared to the width of the fetlock. This desirable shape (which has its analogy in the fore limb, *see* p. 282) is well shown in Figs. 387 to 390. The hock in Fig. 388, which is that of a well-bred saddle nag, is not a particularly straight one, although it is otherwise of a good shape. Fig. 395 is a capital illustration of the defect known as "tied-in" below the hock. Fig. 387 shows a

Photo by] [M. H. H.
Fig. 387.—Large "bone" below hock.

Photo by] [M. H. H.
Fig. 388.—Large "bone" below hock.

Photo by] [M. H. H.
Fig. 389.—Large "bone" below hock.

Photo by] [M. H. H.
Fig. 390.—Large "bone" below hock.

Photo by] [M. H. H.
Fig. 391.—Good hocks and broad gaskins of yearling T.B. filly.

beautiful hock—with great bone and straight-dropped hind leg—of a smart and strong hurdle racer and chaser (Mariner by Geologist). We may contrast it very favourably with the hock in Fig. 393. The hock (that of a thorough-bred) in Fig. 392, though fairly good, is neither so straight nor has such good bone just below the joint as that in Fig. 387. The leg in Fig. 391 belonged to a yearling thorough-bred filly, which was by Highland Chief, and which had, as we can see from the photograph, remarkably good hocks for her age.

We are all agreed that a horse should have large hocks, an expression which—granting that its shape is good in other respects—is synonymous with "strong hocks." If we find that a horse is not "tied-in" below the hock, and that his gaskins are broad (*i.e.* his *os calcis* long), we may rest assured that his hocks are of good size.

As the diseases and injuries of the hock belong to the domain of equine surgery, and as they have been discussed in *Veterinary Notes for Horse-Owners*, I shall not allude further to them here. The desirable absence of synovial enlargements and of an undue amount of cellular tissue will be indicated by the bones, tendons, and ligaments, and by the hollows and eminences formed by them, being clearly defined underneath the skin.

Hocks and Knees well let down.—There is no point in the conformation of the horse, upon which more stress is usually laid, than that which may be described in horsey language as "hocks and knees well let down," or "hocks and knees close to the ground." The cheetah (Fig. 3) has this point well marked. The black buck (Fig. 1), another speedy animal, is, on the contrary, long from his hocks and knees. From an examination of the comparative length of the bones of the limbs (pp. 186 to 190), we know that the proportion of the length of the column of bones below the knee and hock to that of the radius and tibia, respectively, remains more or less constant. How then comes it, we may well ask, that the idea of the hocks and knees

Photo by] [M. H. H.
Fig. 392.—Fairly good "bone" below hock

Photo by] [M. H. H.
Fig. 393.—Sickle hocks and light "bone."

Photo by] [M. H. H.
Fig. 394.—Sickle hocks.

Photo by] [M.H. H.
Fig. 395.—Tied-in below hock.

of some horses being better "let down," than those of other horses, has gained currency ? As regards the fore limb, the answer is easy ; for the knee of a leg which has a comparatively short cannon-bone and a sloping pastern, would naturally be somewhat closer to the ground, than it would be, were the cannon-bone long and the pastern upright. Besides, the appearance of a comparatively long cannon-bone may, I venture to think, give the impression of greater length below the knee and hock, than would be the case, were the cannon-bone short in comparison to the pastern. The popular opinion that the length from hock to toe, as compared to that from hock to stifle—irrespective of the slope of the pastern—is less in some horses than in others, is founded, in all probability, on an optical delusion. If we examine Fig. 389 we shall see a hock which certainly gives us the idea that it is "well let down" ; but a look at Fig. 394 will convey to our minds the opposite kind of impression. And yet if we take a pair of dividers and describe a circle, with the point of the hock as a centre, and its distance from the toe as a radius, we shall find that in the case of both Fig. 389 and Fig. 394, the circumference will cut the curved fold of skin near the groin at the same point! For convenience' sake, I have taken these measurements, which are sufficiently accurate for the purpose in question ; although it would have been more correct to have made them from the hock joint to the toe, and to the stifle joint, respectively. From whence arises, then, this difference of appearance between these two hind limbs, as regards the height of the hock off the ground ? The evident reply to this is the fact that the hock in Fig. 389 being "straight" (p. 314), gives the impression to the observer that it is better "let down," than the "bent" hock in Fig. 394 ; for, as the eye runs down the limb, it will not be so abruptly arrested by the former, as by the latter kind of conformation. Also, the broader the bone is immediately below the hock (contrast Fig. 390 with Fig. 395), as compared to the width of the hind fetlock, the easier will the eye of the observer run down the hind leg.

Shank and Fetlock.—Concerning these parts, there is nothing to add to what has already been written in this chapter and in the preceding one, beyond saying that if the leg is of good width immediately below the hock, its shape will be all right down to the fetlock.

Pastern and Hoof.—(*See* pages 290 to 306.)

Callosities on the Limbs.—The ordinary horse has a callosity (horny growth) on the inside of each fore-arm, nearer the knee than the elbow; on the inside of each hind leg, a little below the true hock joint and immediately over the cuneiform bone (Goubaux and Barrier); and on the back and lower surface of each fetlock joint, in the centre of the tuft of hair which covers that part. The callosities near the knee and hock are called *chestnuts*; and those under the fetlock, *ergots*. The chestnuts on the fore legs are more or less oval in form, and their vertical (greater) diameter is usually about two inches in length. The hind chestnuts are somewhat similar in shape to the fore ones, though a little smaller and narrower. The ergots are less than a quarter the size of the chestnuts, and are more or less round. Goubaux and Barrier state that, on extremely rare occasions, absence of chestnuts from the fore legs has been observed in horses. According to Sanson, the absence of hind chestnuts is of frequent occurrence among the horses and ponies of Northern Africa, although they are almost always present in ordinary breeds. Professor Ewart tells me that about 10 per cent. of the ponies in certain districts of Iceland have no chestnuts on their hind legs. Ergots, though generally present, are absent, according to Professor Ewart, in many Connemara, Hebridean and Iceland ponies; and I have noticed their frequent absence in pure bred Arab horses, and in thorough-breds.

The nearer a horse approaches the heavy draught type, the thicker is the growth of the callosities on his legs; possibly on account of the comparative slowness of his circulation (pp. 323 and 324). Thus, Shire horses, which have an enormous amount of long hair on their legs, often have chestnuts that take the form of small horns (Fig. 396); but the callosities on the limbs of light breeds of horses, are relatively thin.

As comparatively recent ancestors of the horse walked on their fetlocks, ergots are undoubtedly vestiges of pads, similar, as pointed out by Professor Ewart, to the middle portion of the trilobed sole-pads of the dog and cat. Even horses of the present day sometimes use their fetlocks as a means of support, when galloping (Fig. 184).

Careful examination shows that chestnuts and ergots are purely epidermal (p. 323) growths, similar in structure to corns on our toes, and the horny excrescences which form on the hands of oars-men, for instance. Professor Ewart, to whom we are indebted for the elucidation of this subject, has strengthened the theory of the skin origin of the chestnuts and ergots, by proving that in the equine fœtus they sometimes contain hair rudiments, which are also occasionally present in the hind chestnuts of equine hybrids. Such callosities arise only from pressure, and play the part of foot-pads in many animals. The kangaroo, like man, is a plantigrade animal, and has, on each hind leg, an epidermal pad (Fig. 396A) which extends from the fetlock to the point of the hock, and which is a modified counterpart of the rough skin on the sole of our feet; for it is largely developed at the fetlock (first row of the toe-joints) and at the hock (heel), but is only of narrow width under the bones (metatarsal bones) that correspond to the bones of our instep. Similar pads are found in other marsupials, such as the Australian bandicoot, and in the common rat and other rodents. In assuming that the chestnuts are vestiges of foot-pads which existed in plantigrade ancestors of the horse, we are met with the difficulty that, in the horse, the fore chestnut is considerably above the knee, and in the onager (Fig. 339), it is nearer the elbow than the knee; but Professor Ewart has shown that it is close to the knee in the equine fœtus, and that its upward removal is effected by increased

Photo by] [M. H. H.

Fig. 396.—Long chestnut on hind leg.

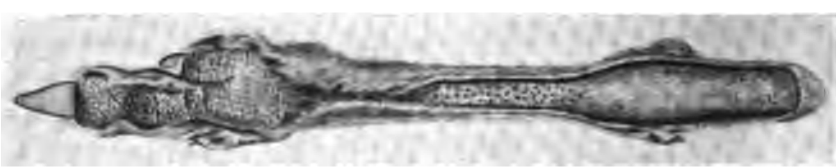

Fig. 396A.—Posterior view of Kangaroo's hind leg, from toe to hock.

growth of the lower part of the principal bone of the forearm (radius). He considers that the fore chestnut corresponds to the pad which is at the wrist (carpus) of the dog and cat, and strengthens this theory by the fact that the fore chestnut in an Iceland pony foal, at birth, closely resembles in shape and structure this feline pad.

Professor Ewart points out that the callosities of the horse agree, as to their inconstancy, with other vestigial structures, which, being no longer factors in the struggle for existence, are very variable. In some cases in which the fore chestnuts are very small and the hind ones absent, there are long spar-like ergots; and in other instances the ergots are absent, although there are well-formed chestnuts on both fore and hind legs.

Some zoologists maintain that the chestnuts are vestiges of scent or sebaceous (waxy or oily) glands, which are found in certain species of deer and other animals. Professor Ewart shows that the chestnuts contain no trace of glands. This glandular theory of the origin of chestnuts is not supported by any valid argument.

Chauveau and other writers are of opinion that the chestnut is the vestige of the first digit (thumb or big toe). Against this idea we have the following facts:—

(*a*). The chestnut has no special connection, bony, ligamentous, or otherwise, with either the bones of the knee or those of the hock. As, in the evolution of the horse, the wasting away of the first, second, fourth and fifth digits began from below, it is unreasonable to assume that a vestige of the first digit would have remained, after all trace of its metacarpal or (as the case may be) metatarsal bone had been lost.

(*b*). The second and fourth metacarpal and metatarsal bones still remain strongly in evidence; yet their digits are represented only by minute vestiges at the end of the respective splint bones, but by no callosities.

CHAPTER XX.

SKIN, COLOUR, AND HAIR.

General Remarks—Skin—Colour—Hair.

General Remarks.—The body of the horse is invested with a covering, the structure and functions of which vary according to its position. It acts more or less as a filter for the watery portion of the blood in its neighbourhood; has the power to effect certain changes in the excreted material; and thus provides itself with a protective layer (*epidermis*), which takes the respective forms of cuticle (outer skin or scarf skin), hair, and horn. The material for this epidermal layer is derived from the fluid which has been exuded from the superficial blood vessels, and is more abundant when the circulation is slow, than when it is fast. Consequently, horses in cold climates have thicker coats and hoofs than those in hot countries. Dr. W. H. Willcox kindly points out to me that various forms of disease in which the circulation is slow, are characterised by growth of the epidermis. Thus, in human tuberculosis, the hair of the scalp and the eyelashes tend to grow long; the skin gets coarse and thick; and the body often becomes covered with fine, downy hair. In cases of myxœdema with weak circulation, and in those of congenital heart disease, the skin is thick and the hair coarse. On the other hand, high fever is often accompanied by loss of hair. In heavy cart horses, we find the growth of hair and horn, especially that of the chestnuts and ergots (p. 319), much more profuse than in thorough-breds; circulation in the former being slower than in the latter. Also, the greater amount of fast work which a horse does, within healthy limits, the finer is his coat. Consequently, profuseness of hair should not be regarded as an indication of vigour.

A curly condition of the hair depends on the hairs being more or less flat; not round, as in straight hair.

Skin.—The chief functions of the horse's skin, as far as we are at present concerned, are: (1) to regulate the temperature of the body; (2) to aid in removing waste matters from the blood; and (3) to protect the body. As the first and second duties are intimately connected with each other, we may consider them conjointly.

The internal temperature being maintained by the changes which take place in the tissues; exercise, by promoting these changes, increases the production of heat. But as it also determines blood to the surface of the body, and thereby stimulates the sweat glands; the surplus heat is removed by an increased amount of evaporation from the skin, which performs this work, and also that of radiating heat, best when it is thin. Although the subject of health is outside the scope of this book, I may remark in passing, that a soft and pliable condition of the skin is due to the fact of the oil glands, which are imbedded in it, being in good order. Granting the employment of clothing when necessary, we may assume that the skin of hard-worked horses, especially those which are engaged at fast paces, should, within reasonable limits, be as thin as possible, consistent with its being able to stand the friction and pressure of harness or saddle-gear.

Colour.—The colours of animals are either pigmental or structural. Thus, the dark colour of a black horse is due to black pigment; and the red colour of a chestnut horse, to red pigment. These two pigments are mixed in varying proportions in bay and brown horses. The white of the hairs of a white horse is, on the contrary, a structural colour, similar to that of the white foam of the waves of the sea, or of white clouds. When alluding, for convenience sake, to grey as a colour in horses, we are of course aware that it is not a special colour, but is a mixture of white with chestnut, bay, brown, or black, as we find in nutmeg greys, flea-bitten greys, and iron greys. When the dark constituent of this mixture predominates to a certain though ill-defined extent, the

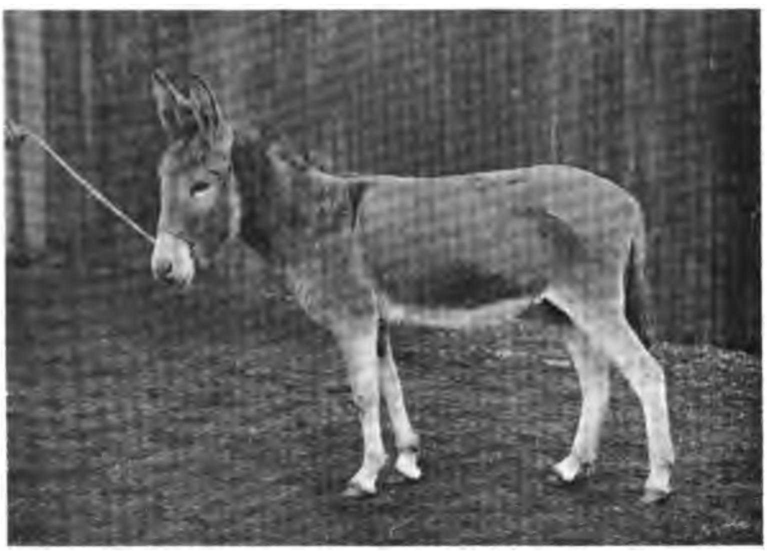

Photo by] [C. REID, WISHAW.

Fig. 397.—Donkey.

resulting colour is generally termed red roan, strawberry roan, or blue roan, as the case may be. As a rule, the white colour in a grey or roan horse's coat is due to some of the hairs being white; although occasionally the ends of some of the dark coloured hairs become light coloured with advancing age, especially in the case of young animals which have had one or both parents white or grey.

As regards heredity, the most persistent colours of the horse are chestnut, bay, brown, and dun. Thus we have chestnut Suffolk Punches, Cleveland Bays, brown Exmoors, and dun Norwegians and Connemaras, as distinct breeds. It is generally believed that a foal from a chestnut dam by a chestnut sire, is always of a chestnut colour; but variation plays such an important part in heredity, that we cannot implicitly accept this statement, although it is undoubtedly correct in the vast majority of cases. Grey and white have but slight persistency, as we see by the fact that not unusually a bay, brown, or chestnut foal is produced by a dam and sire which are grey or white; and a grey or white foal hardly ever appears except when one or both of its parents are grey or white. In accepting von Baer's law, that the history of an individual is the history of the species, we have a strong proof that the wild ancestors of the horse were neither grey nor white; because all grey and white horses are much darker in colour before birth or when foaled, than subsequently. In fact, we all know that every grey horse gets whiter with age. Mr. Wilfrid Scawen Blunt, who is probably the best English authority on Arab horses, tells me that although Arabian breeders, from religious motives, like their stock to be grey or white; the majority of their horses are bays or chestnuts. Black appears to be a much less persistent hereditary colour than chestnut or bay, because in the produce of black dams and black sires, red pigment has a strong tendency to manifest its presence. As a characteristic of a species has a far greater hereditary persistency than a variation, and as dun is a characteristic of many old, semi-wild breeds, I think we are justified in saying that our horses' wild ancestors were probably of a dun colour, which domestication has enriched into bay.

Before horses were domesticated, they required, in the struggle for existence, the aid of colour as a means of concealment from their enemies, and of recognition by their fellows. Protective coloration, to be efficient, must of course be suitable to the special surroundings. We for the first time that the opposite operation is quite possible, viz., that an artist can paint a solid object so as to obliterate the shadows, and as a result to remove all appearance of solidity. . . . Hence, with solidity eliminated and with colour harmony between environment and object, the latter appears to be but a part of the former." As Prjevalsky's horse (p. 640), the tarpan (p. 648), and many horses in countries where artificial selection

Photo by] [G. A. EWART.

Fig. 400.—Yellow dun Norwegian pony.

as regards colour is not practised by breeders, are lighter in colour under the belly than on the upper part of the body (as in dark coloured donkeys, Fig. 397), it is reasonable to suppose that the ancestors of the horse possessed this form of protective coloration.

Many horses have dark stripes or dark markings which evidently have no connection with variation due to domesticity or to artificial selection, because they are always uniform in character, and are much more frequent in wild (p. 640 *et seq.*) and semi-wild horses, than in those which are bred under artificial conditions. As a rule, these markings take the form of a dark stripe down the back (dorsal stripe, Fig. 398), which is often seen in bay horses; horizontal stripes about the knees and hocks (Figs. 398 and 399); an indistinctly defined dark patch on the side of the withers (Figs. 398 and 400); and indistinct stripes across the neck (Figs. 398 and 400). On rare occasions, stripes appear on the forehead (Fig. 401). As these stripes are generally plainer in the fœtus and foal than in the mature animal, we have von Baer's law (p. 326) to support the assumption that the wild ancestors of the horse were striped animals, though not to the same extent as zebras (p. 657). In zebras, the markings, as we have seen (p. 327), are particularly useful in protective coloration; but the markings in the Nubian wild ass (Fig. 402) and in the Somaliland wild ass (Fig. 615), for instance, are too insignificant to take any prominent part in this important function. If we turn to mankind, in order to obtain information respecting the habits of the lower animals, we shall find that "like" always seeks to associate with "like," and in that endeavour, adopts peculiar marks for recognition. Thus, in Southern India, Hindoos put on their foreheads special coloured stripes to indicate the particular caste to which they belong; and in England, the respective apparel of society people and costermongers is equally distinctive. This desire for class segregation is evidently an inherited instinct, which no doubt was formerly more useful for obtaining mutual help against enemies than at present, and is an important factor in the origin of species; the recognition marks having been furnished by variation. We also know that almost any herd of wild animals will evince suspicion, enmity, or alarm on the first approach of even one of their own species which is not garbed like unto themselves. I think we are therefore justified in assuming that the comparatively insignificant stripes of the Nubian wild ass and of the Somaliland wild ass are merely recognition marks; and that the slight differences between the respective stripes of the true Burchell's zebra (Fig. 621), Chapman's zebra (Fig. 623), and Grévy's zebra (Fig. 627) serve a similar purpose. Mr. Selous (*The Living Animals of the World*) tells us that "in the country between

Fig. 401.—Yellow dun Norwegian pony (the face stripes resemble those of the Grévy Zebra, Fig. 301).

Mount Kenia and Lake Rudolph, Mr. A. H. Neumann frequently met with herds of Grévy's and Burchell's zebras consorting together. The contrast between the two species when thus seen side by side was very marked, the former animals looking like horses among a flock of ponies. Mr. Neumann never observed stallions of the two species fighting together, but on the other hand he states that the stallions of the larger species fight viciously among themselves for possession of the mares." The society rules of these animals appear to be much more strict than those of English people, for although they have no objection to associate with foreigners, they marry only members of their own class.

The dorsal stripe is particularly frequent in Karadagh horses (p. 610), and was almost always present in the old breed of Cleveland Bays.

From a working point of view, the colour of a horse's coat, as a rule, does not seem to be of much importance; although we cannot help being favourably impressed with those of rich and decided shades. Personally, I admire most a dark chestnut, or a dark brown with a tinge of rich claret-colour through it, as may be met with on rare occasions. Dark, bright bays are also very pleasing to the eye. Generally speaking, a horse looks best when his legs below the knees and hocks, mane and tail, are darker than the rest of his coat. Bright chestnuts or bright bays, with white stockings and blaze, like many of the descendants of Blair Athol, form, perhaps, an exception to this, supposing that there is not too much white about the face. I cannot help sharing the general dislike to "mealy" chestnuts, and to bays and browns which are lighter on the insides of the limbs and on the lower part of the belly than on other portions of the body. Such animals show resemblance to their wild ancestors, which, if they were living to-day, would be of very little use either in saddle or harness. The existence of this partial deficiency of colouring matter in the skin seems to infer want of nervous power; for we must remember that the distribution of pigment is greatly influenced by the nervous system. The common belief that if one fore leg is dark and the other white, the latter will be more apt to go wrong than the former, holds good, I think, only as far as the skin and hoof are concerned. Many persons consider black a "soft" colour, except, indeed, in the case of cart-horses, which are much admired when of that hue. The prejudice to which I have just alluded is probably due to the fact of many animals of this shade being "foreigners." Grey is undoubtedly an unpopular colour. Apart from any feeling as regards the colour itself, it is true that it gets fainter as the horse grows older, and then unmistakably and perhaps unpleasantly proclaims the fact that the animal

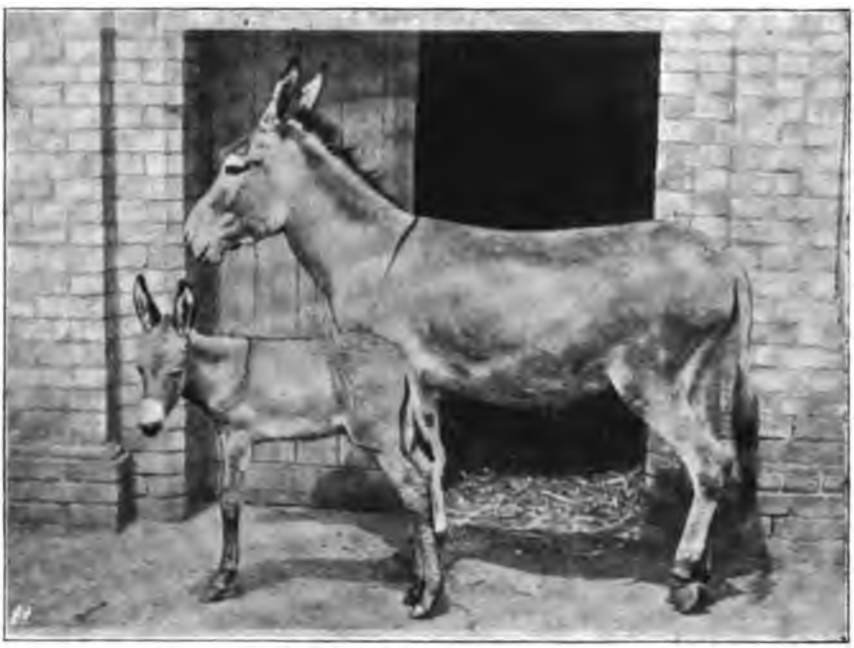

Photo by] [MAJOR J. F. NOTT.

Fig. 402.—Nubian wild ass.

has passed his first youth. Besides this, a grey coat is difficult to keep clean, and is liable to contract stains which are hard to remove. The extra trouble thus entailed, predisposes grooms to dislike grey horses, a fact which may account for the small number of grey horses in England, compared with those met with in the East, where grooms are not so autocratic as in this country. It is a strange fact that grey horses are more liable to *melanosis* than animals of other colours. Shire horse fanciers do not like greys; for the majority of foreign buyers object to them. Some of the best Shires, as What's Wanted and Rokeby Fuchsia (Fig. 403), for instance, are of this hue. For my own part, I am very fond of dark iron or dappled grey with dark mane and tail. A comparatively large proportion of the cleverest hunters I have seen have been greys, a fact for which I can offer no explanation, unless that of their having had Chanticleer blood in their veins. In Leicestershire, moderate performers as a rule, are averse from hunting on a grey horse, whose conspicuous colour is apt to draw attention to sins of commission and omission in too marked a manner to be always pleasant. Blue and red roans, and dun with black points, are supposed to be "hardy" colours. The most showy colours for harness work are bright chestnut and red roan with more chestnut than grey hairs, and free from white patches. When there is a large admixture of white with the red, the colour may be called strawberry roan, which is an ugly hue, particularly if the animal that wears it has a blaze and white stockings. Both piebald (black and white) and skewbald (bay or chestnut and white) may be suggestive of a circus, except in a team; although one of the cleverest hunters I have seen in Leicestershire was a skewbald (Fig. 404). In a hunter, both piebald and skewbald are even more conspicuous than grey. The colours found among high-caste Arab horses are practically limited to bay, brown, chestnut, and grey. The same remark applies to our own thorough-bred stock, except that we have a few roans, and a very small proportion of greys, chiefly through Chanticleer. The general idea that chestnuts are more impetuous than horses of other colours, is one which I do not think worthy of much weight.

The *Farriers' Journal*, December, 1902, tells us that the best and strongest hoofs "are found in black, bay, and most of the roan-coloured horses. When the foot—that

Photo by] [C. REID, WISHAW.

Fig. 403.—Mr. John Parnell's Shire mare, Rokeby Fuchsia.

Photo by] [M. H. H.

Fig. 404.—Captain G. S. Williams's hunter, Joseph. By The King; Dam by Will Scarlett.

is the wall—is made up of dark and slate-coloured horn, the foot is usually strong, and such as the farrier delights to work upon. The chestnut-coloured horse has the worst feet of any class of horse extant. The walls are weak and brittle, and very often flat and shallow. Granted, some chestnut-coloured horses' feet look very nice to the eye, and show off to great advantage when newly shod, but nevertheless, the fact remains that their feet are weak in build and texture, and not the most suitable for road purposes."

The colour of the skin itself is either black, pink, or it may be partly black and partly pink in patches.

The black colour of dark skin is caused by the presence of black pigment (melanin) which is deposited in the deeper layers of the outer skin (*epidermis*). Melanin appears to be derived from the colouring matter of the blood (*hæmoglobin*), because the deposition of melanin in various tissues is a characteristic of malarial fever. Hæmoglobin is contained in the red corpuscles of the blood, a large number of which become destroyed by the microbes of malarial fever during an attack of this disease, and consequently the blood, in these cases, becomes loaded with free hæmoglobin. There is no pigment in pink (or white) skin.

Although the large majority of grey and white horses have black skins; pink skin will invariably produce white hair, and will secrete (at the coronets) white hoofs. Black skin will form dark-coloured horn, even when the coat is white. Although, as I have just said, white horses may have black skins; we shall find that the skin of white markings (stars, blazes, reaches, snips, stockings, etc.) on dark-coloured horses is, as a rule, pink. In fact, I venture to say that the skin of white stockings is always pink, and consequently the hoofs of these legs will be white; provided of course, that the white hair is continued down to the coronet. In the East, we not infrequently see pink-skinned horses, which, of course, are white, and which, according to my experience, are much "softer" in constitution than animals with dark skins. This fact is, I think, chiefly owing to the greater effect the rays of the sun have on skins which are free from pigment, than on dark-coloured skins. Besides, as human albinos are generally inferior, intellectually and physically, to their fellows, we may suppose that the same rule holds good with respect to these equine albinos. Experiments show that dark-coloured hair is capable of sustaining greater tension than blonde hair. Hence we have reason to assume that the protective cuticle and horn (both of which, like hair, consist of

Photo by] [M. H. H.
Fig. 405.—Stripe and snip.

epithelium), secreted by dark-coloured skin, are stronger than those formed by pink skin.

English stable-men who make a practice of washing horses' feet, rightly consider that animals which have white pasterns and which are under their care, are more liable to get cracked heels than those which have dark ones. This supposed idiosyncrasy is no doubt chiefly due to the extra amount of washing which the white pasterns receive, so as to give them a clean appearance.

Experience in tropical climates teaches us that the darker a horse's coat is, the better will he stand the effects of the sun. Dark surfaces radiate heat and also absorb it faster than those of a lighter hue, as we may prove by the two following experiments. If we fill with boiling water two crockery teapots of the same form—one being white, the other black—we shall find that if they are both placed in a cool spot, the latter will lose its heat quicker than the former. If, however, they are filled with icy cold water, and are then exposed under similar conditions to the effect of the sun on a hot day, the black one will get warm in a shorter time than its fellow. The skin of natives of tropical climates is darker than that of inhabitants of temperate or cold countries; and in the Arctic regions, the coats of various animals turn white on the approach of winter. In their case, white also acts as protective coloration, by rendering them less conspicuous. As the temperature of the body of the polar bear, for instance, is much higher than that of the atmosphere in which he lives, he can lose nothing on account of his white coat being a bad absorber of heat; while the fact of its parting with (radiating) heat slowly, helps the body to maintain its normal degree of warmth. The skin of the negro, for example, although it absorbs heat quickly, radiates it still faster; and the vapour given off by the skin cools the surface, and tends to prevent the absorption of heat from the atmosphere by the mechanical protection it affords. Also, the pigment which is present in dark skins and is absent in white skins, acts as a protection against the rays of the sun. At first glance, we might, possibly, imagine that if the surrounding air was warmer than the internal temperature (about 100° F. for the horse), no cooling effect could be produced by radiation. When, however, the skin is in healthy and untrammelled action, its temperature, on account of the free evaporation of perspiration, is considerably lower than that of the deeper structures, even when the thermometer stands at, say, 115° F. in the shade. If, under such circumstances, clothing be worn, the garments will soon become almost, if not quite, as hot as the surrounding air, evaporation will be checked, except from the exposed parts, the temperature of the skin will rise, and the cooling process of radiation will be more or less stopped. In this case, any gain which may be obtained in lessening the absorption of heat, by wearing white, as persons do in hot countries, will be a direct gain. During the summer months in tropical latitudes, the hair on a horse's body will, usually, be so

Photo by] [M. H. H.

Fig. 406.—Captain Woolmer's Indian country-bred, Minden.

short and thin, that its presence will offer no impediment to the action of the skin. Agreeably to the foregoing observations, we find that black and brown horses stand heat best; and that white—especially if they have pink skins—and grey animals sustain it comparatively badly. I have frequently observed on hot days in tropical climates that, other things being equal, grey horses sweated far more readily and profusely than those of darker shades.

When a dark-coloured horse has a small patch of white, more or less in the centre of his forehead, it is called a "star" (Fig. 300). If the white spreads over the forehead, it is termed a "blaze" (Fig. 274). If it runs down the nose in the form of a line of no great width, it is known as a "reach" or "stripe" (Fig. 405). A white or pink patch on either lip is called a "snip" (Fig. 405). White, reaching down to the coronet, on the leg of a dark-coloured horse, is, as we all know, termed a "white stocking" (Fig. 406), an expression that might be reserved for one that comes up close to the knee or hock; while that of a "white sock" (Fig. 324) might be used to signify the marking when it is shorter.

Dark and more or less oval spots on a light ground are characteristic of the majority of Pinzgauer horses (Fig. 407), some of which fail to inherit this peculiarity. Strange to say, this kind of marking is admirably shown in the half-bred Japanese gelding of Fig. 408.

Hair.—The hair of the horse may be roughly divided into the fine and comparatively short hair of the coat, and into the coarser and longer hair which is known as "horse-hair," and which forms the fore-lock, mane, tail, tuft of hair at the back of the fetlock, and the "feather" on the legs of Shires and Clydesdales. No sharp line of distinction can be drawn between these two kinds of hair, on account of the vast variety of intermediate forms. Long, coarse bristles are found about the muzzle of the horse, and a few above and below the eyes. They proceed from roots which are largely supplied with nerves, and consequently they act as delicate organs of touch (tentacles). "As a horse is not provided with hands or paws, he is dependent chiefly on his muzzle for purposes of feeling, a fact which is proved by the presence of these bristles on it, and by the great mobility of his upper lip. The bristles on the muzzle no doubt materially aid a horse in the selection and gathering of food. Also, the hairy feelers about his eyes help to save these organs from blows, when he is moving about in the dark. As all these bristles conduce to his well-being, they should be retained, despite their being regarded by some persons as an eye-sore. Like the hairs of the coat, they gradually thin-out towards their ends. Consequently, their action as organs of touch would be interfered with by

Fig. 407.—Pinzgauer entire.

cutting them, which operation would also lessen their pliability. We may therefore conclude, that if the bristles round a horse's muzzle be cut, he will suffer from discomfort, if not pain, when he attempts to feed, or when he is handled about the mouth, as for instance, in bridling him. Besides, clipping them gives a horse the disfiguring appearance of being badly in want of a shave! Although there can be no great objection to occasionally pulling out one or two of these bristles which may be longer than the others, the frequent practice of thus removing them should not be allowed; because it deprives the animal of a useful means of touch, and also inflicts such severe pain on him, owing to the high sensibility of the roots of these hairs, that the unpleasant recollection of the sharp twinges will in all probability make the horse more or less difficult to handle about the muzzle" (*Stable Management and Exercise*).

The eye-lashes are practically confined to the upper eye-lids. The functions of the fore-lock, mane and tail have been respectively described on pages 212, 224 and 256.

The protection against cold which a horse's coat affords him, is chiefly due to the fact that a large amount of air is retained between the hairs of that covering; air being twice as bad a conductor of heat as hair. In this case, the hairs of the coat require to be close together, so as to prevent movement among the retained particles of air. Hence we find that in very cold climates, the hairs of the coats of horses are long, fine and numerous. If such a coat was exposed to rain, it would become rapidly soaked with water, which is nearly twenty times as good a conductor of heat as hair. We therefore find that in damp climates, the hair of horses is relatively coarse, as for instance, in Shire horses.

The possession of a fine glossy coat will naturally indicate that the skin is in active working order, and consequently in good condition for removing the surplus heat generated in the body by hard labour. The Desert Arabs, who have no objection to their entires having thick manes, consider that unless a horse has a thin tail, he cannot be of high caste. The same idea seems to have given rise to the saying that one never sees a bad rat-tailed horse.

Agreeably to the remarks made on p. 323, we find that the hair on the legs of horses of the heavy draught type is longer than that on the legs of riding horses; but the abnormally great length of the hair on the legs of Shires the true skin, we may infer that if the former is thick and coarse, the latter will be strong and harsh, and consequently, the oil which is secreted to keep the surface soft and supple, will not be able to perform its duty as efficiently as it would do, were the scarf skin thin. When the scarf skin gets hard and cracks from the effects of climate and from its being insufficiently supplied by this oil, the highly sensitive true skin becomes inflamed from irritation due to exposure. The fact of cart-horses being peculiarly liable to "sallenders," if they are blistered for "bog spavin," taken in connection with the coarseness of their hair, as compared to that of lighter breeds, would seem to support the opinion that the coarser the hair, the more liable is the animal to suffer from inflammation of the skin, of which grease is a form that is very difficult to entirely allay. We might safely conclude that if hair on the legs be desired, it should be soft and silky in its nature. Mr. Thomas Dykes, in his essay on *The Clydesdale Horse*, states that "the back part from the knee down should possess a nice flowing fringe of silken hair, which should spring from the very edge of the bone. This hair should be of what a judge of a Skye terrier would style a 'pily' nature; and good judges will not have a horse at all, the feather of which has a coarse matted appearance. The high value set upon nice silky hair is on account of its being an indication of strong, healthy bone, and as hair of a short coarse matted kind suggests a tendency to grease."

CHAPTER XXI.

ACTION, HANDINESS AND CLEVERNESS.

Action.—*General Remarks on Action.*—The three chief requisites of action, from a useful point of view, are : sure-footedness, effectiveness, and lightness, so that the limbs may not unduly suffer from the effects of concussion. As remarked many years ago by Dr. Carson, the safety of a horse's action depends on the way he puts his feet down, rather than on the manner in which he picks them up. We should therefore, from this point of view, attach no value to high action, beyond what is sufficient to enable the animal to avoid striking his toes against any inequalities that may be on the surface over which he is going. The stability of the fore limb, when the foot comes on the ground, depends, to a great extent, on the knee being kept straight, which is mechanically done, without the expenditure of muscular force, if a line drawn from the heel to the centre of the elbow joint, falls at that moment in front of the centre of the knee joint. The more upright the pastern, the further will this line be drawn back as regards the position of the knee. As the shoulder-blade and pastern are at opposite ends of the column of bones of the fore limb, and as they both slope in the same direction, it follows that the degree of slope of the shoulder will influence that of the pastern. Hence, for safe action we should seek for oblique shoulders, sloping and long pasterns, knees in which there is no tendency to "stand over," and lightness of fore-hand.

For effectiveness, the action should be the happy medium between the cramped style of going, and one in which command over the limbs is, to a great extent, lost by the stride being too long.

The term, lightness of action, signifies well-balanced movements of the limbs, by which undue weight is thrown on none of them, and particularly not on the fore-hand. The action, from a "level" point of view, is influenced by the conformation of the body, and by the

Photo by] [M. H. H.

Fig. 409.—Trotting.

carriage of the head and neck. To be perfect at fast paces, we require the animal to be light in front; to have oblique shoulders and sloping pasterns, so as to have full power to raise the fore-hand; and to have good loin muscles. The carriage of the head and neck has been discussed on page 84, *et seq.* In heavy draught we do not require lightness of action, which is directly opposed to the faculty of being able to throw weight into the collar.

The Walk.—At this pace, like at all others, the shoulders should work with the utmost freedom, and the fore foot should be thrown well to the front and only high enough to clear and cover the ground. We may see this beautiful play of the shoulders to perfection in young thorough-breds.

The hind legs should be swung freely to the front, so that they will considerably overstride the imprints made by the fore feet. Viewed from behind, as well as from the front, the near and off pair of legs should respectively move in the same line, so that there may be no " dishing," or crossing of the legs. The hocks should have no in-and-out movement, as may be sometimes seen, and had better work rather close together than wide. Any tendency to stumble or knuckle-over behind is a serious fault, unless it be solely due to bad shoeing. If the horse be given a long rein, when he is being ridden, he should carry his head rather low and well advanced, and should be able to walk at a rate of about five miles an hour.

The Trot.—At the fast trot, the fore leg should be brought to the front with a straight knee, the foot appearing as if suspended for a brief moment (Fig. 409) before being placed down. Even in match-trotting, the knee should not be raised higher than what would be sufficient to make the fore-arm horizontal (Fig. 410), or not quite so much. The hind legs should be carried well forward, and should work in perfect unison with the fore limbs (Fig. 411). Nothing looks worse than to see a horse trotting high in front, and dragging his hind legs along the ground. As I have already remarked, with reference to the walk, there should be no " dishing " or crossing of the legs, so that, when viewed from behind, a clear space will be preserved between the near pair and the off pair of legs. The term, " dishing " with a fore leg, means that the horse turns the foot outwards when he raises it off the ground. In the trot, the head should be carried much higher than in the walk ; as the limb has to be raised to a greater extent. Fig. 412 shows the " extravagant " action which is greatly prized by admirers of fashionable harness horses.

The Gallop.—In order that the animal may utilise to the utmost his forward reach in the gallop, the knee of the leading fore leg should be kept as straight as possible, while that leg is being extended to the front. In fact, the straighter it is at that moment, the more perfect will be the front action on level ground. A race-horse should, like a ballet-dancer, move as if he had no knees. It is well to qualify this praise of low action by remarking that a horse which bends his knees a little, is better suited for going up a hill, than a " daisy cutter " ; as his " round "

Photo by] [BAKER ART GALLERY, COLUMBUS, O.

Fig. 410.—Mr. George H. Ketcham's ex-champion American trotter Cresceus (2.02¼, on the inside).

style of going will aid him in climbing the ascent. The shoes should be as light as practicable, so that the weight of the iron may not interfere with the animal's action to any perceptible extent. In India, where but very little rain falls during the racing season, I always found that horses I had in training ran best unshod, supposing of course that their feet were strong enough to do their work without artificial protection. This practice of running and training horses without shoes is largely adopted in Australia, which, like India, has a dry climate, We should bear in mind that the ability which the horn of the hoof has to stand wear, chiefly depends on the "going" being dry and comparatively soft. English trainers are beginning to see that, when practicable, it is well to run horses without shoes, but unfortunately the dampness of our climate greatly hinders the success of this attempt. The benefit to be derived from running horses unshod, is principally due to the fact that the muscles of the limbs act to greater mechanical advantage, when the hoofs are in a normal condition, than when they are shaped according to the conventional ideas of the ordinary blacksmith, who, as a rule, errs chiefly by omitting to sufficiently lower the toes of the hind feet, which, then, are consequently less upright than normal hind feet. This mechanical question, which has been discussed on pages 73 and 74, is of much more importance with respect to the hind feet, than to the fore, because the former play a much larger part in propulsion, than the latter. As the position of the rider puts more weight on the fore-hand, than on the hind-quarters; the hind feet of the saddle horse are less exposed to wear, than the fore feet. Hence a trainer can often train and run his horses unshod behind, although he may be obliged to have them shod in front, which is a matter of minor consideration.

I have mentioned, on page 88, that curb bits are objectionable for use with race-horses, on account of their tendency to make horses gallop "round," or to "fight" in their action. In the former case, the animal will carry his head low and bring his chin into his chest, with the object of transferring the pressure of the bit, as much as possible, to his poll, over which the head-piece of his bridle passes, and will consequently bend his knees too much. In the latter case, the animal will keep his head stuck up in the air, probably, in the vain attempt to get his jaw away from the painful contact of the curb chain.

If we observe a "true" galloper, we shall note that he holds his head and neck in a more or less uniform position (p. 90), so as to enable the muscles of the neck to work in a regular manner.

The hind legs, at the gallop, should be brought well forward under the body, with particularly quick recovery after having been straightened out. Their action, like that of the fore-hand, should be characterised by the machine-like regularity of their forward and backward sweep. The limbs should move in such perfect accord one with the other, that there will be the least possible rise and fall

Photo by] [M. H. H.
Fig. 411.—Trotting.

Photo by] [M. H. H.
Fig. 412.—Extravagant action at a slow trot.

of the fore-hand; for if the weight be depressed at one moment, it will have to be raised during the next, by an expenditure of force which will be wasted as far as progression is concerned.

Leaping.—In Chapter XIII. we have seen that the "take-off" in the leap consists of the raising of the fore-hand and in the propulsion of the body. Hence, at that moment, the animal should have his head raised and somewhat drawn back, so as to "lighten" the fore-hand, for which object, and in order to be able to fully bend the hind legs, he should have them well under him (Fig. 224). To obtain the maximum effect of propulsion, the horse should straighten his hind legs to their utmost extent

(Figs. 243 and 244); and to clear the object, if it be one that is likely to tax his powers to "negotiate," he should raise his knees well and should bend them as much as he can. The instant the hind feet quit the ground, they should be drawn up as quickly as possible and close to the body (Fig. 246), so that, in high jumping, they may not catch in the fence, but be ready to save the animal from a fall in the event of an accident, and to enable him to land in safety. On clearing the obstacle, the fore feet should be brought well to the front, and as they respectively come to the ground, their knees should be quite straight (Figs. 228 and 251). The head should be somewhat raised and the muzzle drawn in a little, so as to bring the weight back, and to enable the horse to see where he is going to place his feet.

Handiness and Cleverness.—The "handiness" or "cleverness" of a horse depends on his conformation, disposition, and training. Animals which have been brought up in "the open," on rough and mountainous ground, are far cleverer, as a rule, than those which have spent their early youth in small paddocks. It goes almost without saying, that a placid-tempered animal would be easier to stop or turn than an excitable one, and would be consequently handier; but I cannot say that he would be cleverer. I have known several terribly hard-pulling steeplechasers which were as "clever as cats," and always had a "spare leg" for every difficulty, provided their rider did not interfere with their mouth; and I have seen other equally stiff-necked, cross-country horses, whose sole delight, no matter how lightly they were handled, seemed to be punching a hole in every fence they met. Some temperate ones are just as "chancy," apparently from pure laziness; though many quiet animals are incapable of making a mistake.

The points of conformation which conduce to handiness and cleverness in the saddle-horse, are :—

1. Well set on head and neck, so that the horse may be able to bend readily to the rein.

2. Light in front (head, neck, and shoulders), and having well sloped shoulders and oblique fore pasterns, in order that the animal may be able to raise his fore-hand with ease, and bring his weight back.

3. Strong loins. We must remember that the upper loin muscles are "rearing muscles" (p. 67), and that the lower ones assist to bring the hind legs under the horse.

4. Strong hocks.

5. Croup, somewhat drooping (pp. 310 and 311).

CHAPTER XXII.

CONDITION AND GOOD LOOKS.

Condition.—I use this term here to signify the bodily state in which a horse can, in the best possible manner, do work that will test the power of his lungs and muscles to the utmost. I shall make no reference to "dealers' condition," or "show condition," which is a subject that does not come within the scope of conformation.

A horse to be in condition must be healthy and sound; must have his breathing apparatus in the best possible working order; his muscles developed to the highest degree of perfection, with regard to the nature of the task they have got to perform; and the amount of fat in his system reduced to a minimum consistent with health.

I shall now glance at the chief signs of condition in the horse.

1. *Health.*—The ordinary indications of health are: coat, bright; skin, cool (except when heated by exercise, or by the sun), soft and loose over the muscles; eyes, bright and soft in expression; visible mucous membranes of the eyes and nostrils, healthy looking; mouth, sweet smelling; internal temperature (in health about 100° F.); pulse (from about 35 per minute for heavy cart-horses, to about 45 for small ponies); and rate of breathing (10 to 12 per minute, when at rest), normal. The dung should be fairly well formed, free from mucus, and from any offensive smell. The appetite as a rule should be good; although horses may become a bit

" dainty " in their feeding, when they have been wound up in their training to " full concert pitch."

2. *Development and Leanness of Muscles.*—The muscles of the croup (those over the quarters) should present a rounded surface, and those over the loins and back, at each side of the backbone, should stand out in bold relief. The line (the " water-mark ") down the rear portion of the thigh (Fig. 346) should be clearly apparent. The muscles

Photo by] [CLARENCE HAILEY, NEWMARKET.

Fig. 413.—Mr. J. Bell's Prince Charles II.

which are just above the fore-arm should form a rounded mass, and those of the shoulders should be well defined. There should be over the ribs a thick sheet of muscle, which should show well above the level of the part of the flank in rear of it. This muscular covering of the ribs terminates abruptly in an irregular line which goes downwards and backwards in the direction of the groin, and which can be seen plainly only when there is no excess of fat about the part. In forced respiration (p. 51), the muscles which cover the ribs are brought into active play, and they consequently become largely developed by the process that brings the galloper, or fast trotter, into condition. Hence, if there be in a horse a marked difference of level between the surface in front of the line in question, and that in the rear of it (Fig. 277), we may reasonably conclude that he has done a good deal of that kind of work which brings his lungs into rapid action and that his system is not everloaded with fat. The fact of the " water-mark " being clearly indicated is also dependent on the absence of fat about the part.

The line which marks the termination of the sheet of muscle to which I have alluded, corresponds to the posterior border of the fleshy portion of the *panniculus* (p. 42), and indicates the commencement of the aponeurotic portion. The " water-mark," or " quarter-mark," to which I have also drawn attention, is the line of separation between the *rotator tibialis* and the *abductor femoris*.

The most time-honoured method of ascertaining whether or not a horse is in condition, is to feel his crest with the hand, so as to find out if it be hard or soft. This plan has its merits; for the crest is a part on which many horses, especially entires (Fig. 413), have a tendency to deposit fat. It is evident that a thick layer of fat would feel softer to the touch than a mass of ligament, muscle and tendon; and that the nearer a horse approaches the cart-horse type, the heavier is his neck (Fig. 312).

The diagonal line on the flank, the appearance of the ribs through a thick layer of muscle, and the lean though muscular condition of the shoulders of a race-horse in training, are well shown in the photograph of Ormonde (Frontispiece).

3. *Signs of condition afforded by the state of the breathing.* —Although a practical trial would give an experienced observer the best possible idea of the state of an animal's organs of breathing; the question depends so much on individual merits and defects, that it is very difficult to lay down any fixed rules for guidance in making such

a test. Supposing that the horse has done his work in what we consider a satisfactory style, we may prove the correctness of our judgment, by observing the manner in which he recovers from the effects of his exertion. If after a sharp "rough-up," his lungs resume a tranquil form of breathing, after he has rested or (better still) has been walked about for a few minutes, and if he does not show any appearance of being distressed by the severity

Photo by] [M. H. H.

Fig. 414.—Mr. H. T. Barclay's Franciscan.

of the work, we may fairly conclude that his "pipes" are in good order. Trainers generally think that the fact of a horse "blowing his nose" (as a kind of sneeze which these animals sometimes make after a quick "spin," is called) is a sign of the wind being all right. If the wind of a hunter is not "clear," he will be unable to quickly "come again," if he gets out of breath during a run, even if he be "eased off" for a little, with the object of letting him "catch his second wind." If a strong gallop has the effect of making a horse unusually thirsty, we may doubt that his lungs are in good order. To find out, in doubtful cases, whether or not a horse is a roarer, we had best, immediately after the animal has done some fast or severe work, apply the ear close to one of his nostrils.

Large calibre and thinness of the walls of the nostrils, which condition predisposes a horse to "high blowing," is a sign that the animal's organs of breathing are naturally good.

4. *Signs of condition manifested by the state of the sweat.*—The fatter a horse is, the thicker and more greasy will be his sweat. When a horse is in condition, his sweat will come off like water, will have lost the saline taste it previously had, and, unless the animal is in a state of excitement, it will dry on the skin with extreme quickness, as soon as the work which has opened the pores has been stopped. If a horse which has no excess of fat in his system, shows a tendency to sweat on a very slight provocation of work or "closeness" of atmosphere, and if the perspiration thus induced, takes a long time to dry on the surface of the body, we may reasonably conclude that general weakness is the cause of this excessive action of the skin. When a horse sweats from excitement (as on a race-course), the surface of the body thus moistened will not dry quickly; for as long as the excitement lasts, the outpouring of the fluid will more or less continue.

Good Looks.—Beauty in the horse is dependent:—

1. On the uniformity of type which the various parts of the body bear to each other. Thus, a Shire or Clydesdale horse, with his Roman nose and loaded shoulders, may be quite as handsome as a good-looking English thoroughbred, or a showy, high-caste Arab.

2. On the artistic arrangement of the lines of his body. We may see the importance of this from a beauty point

Photo by] [J. Delton, Paris.

Fig. 415.—Black Orlov-Rostopchine stallion.

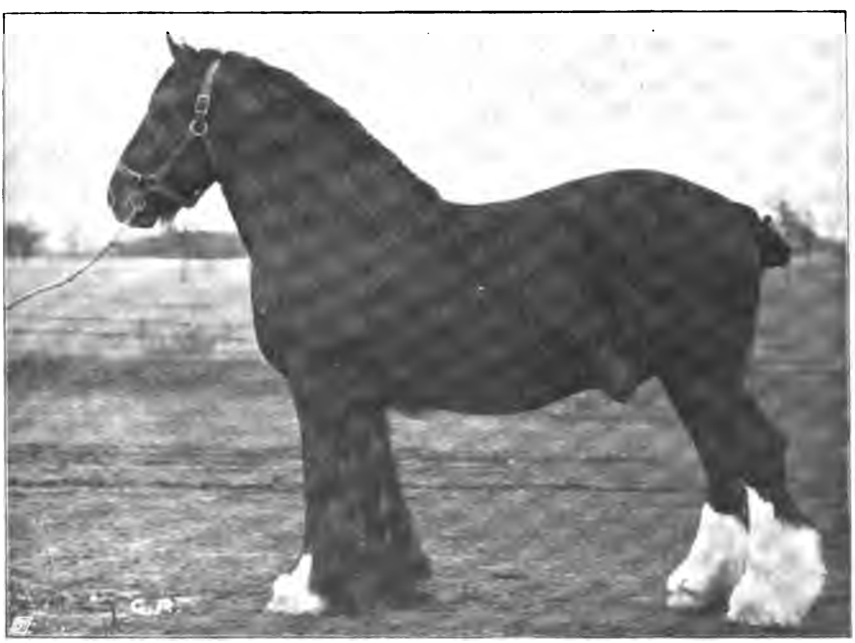

Photo by] [C. Reid, Wishaw.

Fig. 416.—Lord Belper's Shire Stallion, Rokeby Harold.

of view, if, for example, we contrast a photograph of a horse having the ears pricked forward (Fig. 305), with another one of the same animal, taken a moment afterwards, but having the ears in their usual position (Fig. 304). The former may look handsome, and the latter plain; although the two may be absolutely identical in every particular, except in that of the ears. The "line of beauty" (alternate convexity and concavity; or *vice versâ*) is well exemplified from the tip of the off ear to the top of the croup, in Fig. 309; in which there is, however, a too sudden depression of the quarter. The outlines of the tail are very graceful in Fig. 593. The curves from tip of ear to end of tail are also good in Fig. 308, except that the line of the crest might be slightly more convex. For beautiful curves of the upper line of the body, from tip of nose to tail, *see* Figs. 282, 413, 414, 415, 416, 420, and 593. One reason (which possibly might escape the notice of a casual observer) why the pictures or photographs of some horses (Figs. 277, 487, and 593) look well, is that the curves of the under part of the body—from muzzle, lower lip, along lower jaw, under throat, down neck, in front of chest, along the belly, under groin, and carried in front of both hind legs—are very graceful. In all cases, oblique shoulders, sloping pasterns, long and well-arched back ribs, muscular loins, more or less horizontal pelvis, tail set high up, straight-dropped hind leg, will be beauties.

As heavy cart-horses are often somewhat "back at the knees" (p. 280), the presence of a good supply of fine hair behind the back tendons, increasing in amount from the knee to the fetlock, will balance this concavity. Docking, being a mutilation of sensitive and useful structures, does not improve the appearance of a horse, except when a deformity of the tail renders this operation necessary. The removal of the forelock, when hogging the mane, is always an eyesore. Whenever good looks are studied, the mane should not be hogged, if the animal has a light neck. As a horse is looked at more frequently from the near than from the off-side; his mane, as a rule, should fall to the off-side.

Under this heading we must also put good carriage of the head and tail, and true and showy action. For carriage of the head and neck, *see* p. 84, *et seq*. The tail during movement should be held well out, with the hairs falling from it in graceful curves. To look well at the walk or trot, the limbs should work in lines parallel to the direction in which the horse is going; for any crossing or dishing of the legs will detract from the grace of their movement. Somewhat lofty, "cadenced" action in the walk or trot of the hack or charger will be pleasing to the eye, as it will suggest the possession of force and speed held well in reserve.

A bright, intelligent expression of face, which is greatly assisted by the movements of the ears, adds much to the beauty of the horse.

As regards colour, *see* Chapter XX.

CHAPTER XXIII.

WEIGHT-CARRYING AND STAYING POWER.

Weight-carrying Power.—The special points for weight-carrying power are :—

1. Length and obliquity of shoulder-blade (p. 266 *et seq.*).

One might be inclined to think that very oblique shoulders are not an advantage from a weight-carrying point of view; for they necessitate the saddle being put farther back on the horse, than would be the case with shoulders of only a moderate slope. At the same time we must remember that with horses of the same depth of body at the withers, the more oblique the shoulder-blades, the longer they will be.

2. Strong shoulder muscles are particularly necessary for carrying a heavy burden, because the fore legs, especially at fast paces, have to bear more weight than the hind legs (p. 53). As some of these muscles lie between the withers and top of the shoulder blade, on each side; good weight-carriers will generally have their withers more or less thick.

3. Strong loin muscles.

4. Good substance of bone.

Ormonde (Frontispiece), "the horse of last century," St. Gatien, the dead-heater for the Derby and winner of the Cesarewitch, and Cloister (Frontispiece), were horses of great bone, and marvellous weight-carriers.

5. Pasterns not too sloping.

6. Absence of undue weight of body beyond that which would be necessary for the movements of the limbs, and for the performance of the various vital functions.

The foregoing rules would apply to all classes of horses. For absolute weight-carrying power, the animal should have short legs (a fact which would be incompatible with the

Photo by] [M. H. H.
Fig. 417.—Indian pony (*Tattoo*) in an Ecka.

possession of speed), and should have his pelvis somewhat drooping.

Staying Power and Endurance.—The ability to "stay a distance," granting the possession of health and condition, depends (1) on the respective powers of breathing and digestion being good; (2) on the muscles working to advantage; and (3) on the action.

The first condition has been discussed on pages 8, 10, 230 to 236.

The second condition will be best fulfilled, in the riding horse, when the muscles over the loins are powerful, and when the fore-hand is light; that is to say, when the shoulders and pasterns are oblique, and the head, neck and shoulders light, in which case the fore legs will not be wide apart (p. 244). As thick muscles are unsuited to bear the strain of continued quick work, we usually find that genuine stayers at fast paces are not heavily built horses. Any excess of height over the croup, as compared to that at the withers, will add to the weight on the fore-hand (p. 53). The fact of the neck (p. 218) being abnormally short in comparison to the limbs, will naturally detract from the staying power. The same remark applies to the possession of "sickle-hocks" (p. 66). In heavy draught, the mechanical advantage will be on the side of a heavy fore-hand.

In some breeds of horses, there is an important difference between staying power (using the term in its racing sense), and ability to endure long continued fatigue. For instance, East Indian ponies, though often very fast for a short distance, are notoriously bad stayers; and yet they are wonderfully good animals on a long journey. Thus, many of them which are incapable of "getting" beyond three furlongs in a race, would, if harnessed to an *ecka* (Fig. 417), do, comfortably, 70 or 80 miles from sunrise to sunset, with the thermometer at noon up to 110° F. or more, in the shade. Here the lack of staying power is due to the organs of breathing being unable to continue work under high pressure. These "country-bred" ponies (Figs. 417 and 602), though long in the legs, have plenty of room for their digestive organs, in comparison to the size of their bodies (pp. 232 to 236). With thin necks and light shoulders, their good legs and feet have but little weight to carry; and as the quality of their tissues is of the best, and their spirit undeniable, they can go marvellously long distances without getting knocked up —provided always that they are not over-paced or over-weighted. It is evident that a genuine stayer will be capable of appearing to advantage in a "go-as-you-please" task; for he will possess all the good points of the other, with better organs of breathing. The small amount of extra weight (on account of increased length and rotundity of the back ribs) which stayers have to carry, will be more than compensated by the larger space allowed for their digestive organs. As a rule, in proportion to their respective sizes, small horses will stay better, and will be capable of enduring more fatigue, than big horses. The reason for this appears to be that the former have more vitality than the latter, on account of the rate of the circulation of their blood being quicker.

I need not point out the advantages of good action in the present connection.

CHAPTER XXIV.

BLOOD, SYMMETRY AND COMPENSATIONS.

Blood.—The relation of "blood" to conformation is its only one which need be considered here.

The term "blood" usually signifies more or less pure descent from animals mentioned in the English Stud Book, or from high-caste Arabs. In our Colonies, the initials T.B. have a more elastic application than in the mother-country. As English thorough-bred horses have been bred almost entirely with the object of their utilisation on the Turf; their conformation more or less resembles that of the galloper. Were I to be asked to particularise the "point" or "points" most characteristic of the English "blood" horse, I would answer: "The legs below the knees and hocks." Their special peculiarities, in this respect, are: lightness of bone, thinness of skin, fineness and shortness of hair, small amount of underlying connective tissue, near approach to parallelism of back tendons to cannon-bones, with consequent smallness of fetlock joints (p. 282), good length of pasterns, and small hoofs with well-arched soles. The speed of the thorough-bred is the result of careful selection in breeding, by which the best conformation for fast galloping has been obtained, and also the most suitable kind of nervous organisation. The effect of heredity is specially shown in the working of the nerves, which regulate the exhibition of all muscular force. Although they can in no way increase the actual strength of a muscle, its failure of success in putting forth its full power, and also its speed of contraction, are dependent on them. Hence, two horses of identically the same "make and shape" (if such a thing were possible) might differ widely in pulling power, handiness, or speed, on account of a want of similarity in their nervous systems. We see this fact well marked among men, in whom uncommon quickness and great dexterity of muscular movement is often inherited. The speed thus obtained from "blood" independently of conformation, may be regarded as an outcome of heredity. In judging, therefore, by a horse's conformation, of his suitability to any particular kind of work, we should take into careful consideration all the "blood" points which he may possess. The fact of a horse having Arab blood in his veins, is, in itself, no reason for our inferring that he has a good "turn of speed"; for Arabs, though charming hacks and admirable light cavalry troopers, are not race-horses.

It is noteworthy that thorough-bred stock which are allowed (as they often are in the Colonies) to run wild, say, up to four of five years old, before they are taken up, and which are then put to ordinary labour, lose in a great measure the blood-like appearance they might have possessed, had they been handled early and put into training in the usual way.

Symmetry is the conformance, as regards size, shape and arrangement, of the various parts of the body to some particular type of useful horse.

In violation of this condition, we may have united in the same animal the long legs and light body of the race-horse, and the heavy head, loaded neck and thick shoulders of the cart-horse; or the contours of the race-horse, with the exception of the loins being weak, and the hind legs short with drooping croup. Even with the ordinary saddle-nag, to say nothing of the hunter and officer's charger, we have too often the massive shoulders of the draught-horse. A heavy head, which reveals but too plainly a cart-strain, is a terrible eyesore to an animal whose neck and shoulders are light, and which might otherwise be a high-class hack.

We may see weak loins in short-legged, deep-bodied cart-horses which have great power of limbs and shoulders. A horse which has oblique shoulders should also have sloping pasterns and a horizontal croup. We must here allow for the fact that "work" often renders the pasterns abnormally upright. We may witness many instances of want of symmetry in the "tying-in" of the legs under the knees, short pasterns, and large, flat feet of long and slender-limbed horses. Fig. 347 shows a mare that was of fine width just below the hock (p. 314), but was tied-in below the knee. A mean carriage of the tail will contrast very unfavourably with a showy and graceful bearing of the head and neck.

The generic term "weed" is usually applied to long-legged animals which are weak in the loins, and are light in the back ribs. As a rule, the cause of their comparative worthlessness is wrongly attributed to the length of their limbs, rather than to their defects of loin and back ribs. If we compare Fig. 318 with the Frontispiece, we shall see that Epsom Lad is "longer" and "lower" (taking the proportion between his height at the withers and his length of body) than the deep-ribbed and strongly "coupled" Ormonde. It is evident that no amount of shortening of his legs could make his conformation perfect, from a useful point of view.

Compensations.—The points which I shall consider under this heading have special reference to the saddle-horse and light trapper :—

"*Plainness*" *of head* will be best "carried off" by a "kind," intelligent expression of face ; quick play of the ears, which appear to most advantage when they are small ; good carriage of the head ; and graceful setting-on of the head with the neck. The thickness of the latter should conform to that of the former.

Undue lightness of neck.—Full mane; light head, small ears, sloping and flat shoulders.

Heavy neck and loaded shoulders may be corrected to some extent, from a beauty point of view, by a good-looking, intelligent head, nice crest, and light mane. From considerations of utility, the shoulders and pasterns should be sloping; the bones, muscles, tendons, and ligaments of the fore limb below the shoulder, strong; feet, good; and loins and hind quarters, powerful. For cross-country work, strong and sloping fore pasterns are the best compensation for shoulders that are upright and heavy.

Fore legs below the elbows too light; Pasterns too upright, or too oblique.—Legs otherwise well-shaped; light fore-hand; sloping shoulders; and good loins.

"*Calf knees,*" *or* "*over at the knees.*"—Strength of leg below the elbow; parallelism of back tendons with cannon-bones (p. 282); sloping shoulders; light fore-hand; strong loins.

Ribs "*flat-sided.*"—Good depth of body at lowest point of back; flanks well ribbed-up.

Too hollow in the back.—Light fore-hand, sloping shoulders, and in all cases, broad, powerful loins, which is the best kind of compensation in this instance.

Loins too light, and flanks badly ribbed-up.—Light fore-hand; shoulders and pasterns oblique; well-rounded barrel; strong hind-quarters; good gaskins; "straight-dropped" hind legs.

Hind-quarters too light.—Light fore-hand; shoulders and pasterns oblique; light, but well-rounded barrel; muscular loins; good gaskins; "straight-dropped" hind legs.

"*Sickle hocks.*"—With this defect in a saddle-horse which is required for fast work, it would be well for him to have good length of hind legs, the possession of which will presuppose that of a horizontal pelvis ; and the compensations mentioned in the preceding paragraph, with the exception of " straight-dropped " hind legs, which is the opposite kind of comformation to that which we are considering.

CHAPTER XXV.

SPECIAL POINTS OF VARIOUS CLASSES.

The Race-horse—The Racing Pony—The Hunter and Steeplechaser—The Match Trotter and Pacer—The Heavy Cart-horse—The Harness-horse—The Hack—The Lady's Horse—The Cavalry Trooper—The Officer's Charger—The Artillery Horse—The Mounted Infantry Horse—The Light Vanner—The Polo Pony.

The Race-horse.—1. The height of the galloper at the withers, and also over the croup, should be at least equal to his length of body (p. 170, *et seq.*).

2. The depth of the body at the withers should be considerably less than half the height (p. 170).

3. The loins behind the cantle of the saddle should be flat, on account of the presence of largely developed muscles (pp. 67 and 248, *et seq.*).

4. The gaskins should be broad (p. 312).

5. The neck should be long (p. 218).

6. The fore-hand should be light (p. 275). Consequently, the neck should be free from "lumber"; there should be but little width between the fore legs (p. 243, *et seq.*); the shoulders flat and without any "place for the collar" (pp. 275 and 276); and the horse should not be thick between the upper ends of the shoulder blades, in which case his shoulders would be heavy (p. 276).

7. The withers should be high, and should run far back.

8. The hind legs should be long.

9. The hocks should possess the ability of being fully straightened out, as well as bent.

The following are admirable types of English race-horses :—

Ormonde (Frontispiece), by Bend Or out of Lily Agnes, was the best race-horse of the last century. In training, he was a little higher at the withers than long in the body ; and about as high at the croup as at the withers. His legs, though long, were muscular, and their bones strong, as we may perceive from the appearance of his fore-arm and gaskin, and from the shape of the limbs below the knees and hocks. He had particularly straight-dropped hind legs. Although he was in training when this photograph was taken, he shows great depth of body in the centre of the back : a fact which points to the unusual length of his back ribs, and to the admirable shape of his chest for purposes of breathing. It is evident that his roaring infirmity, being a nervous disease of his larynx, had nothing to say to his conformation. As his neck agrees in length with his limbs, and as his withers run far back, he had a very long "rein." His neck, though muscular, was light for a four-year-old entire. He was coarse about the throat, where the head and neck join. The horizontal marks on his legs, on and near his fetlocks, were curls in the hair, due to bandaging. His back view (Fig. 384) shows that he was narrow behind as compared with a middle-weight hunter (Fig. 385). His hocks were particularly good. His tail was placed very high on his croup.

Fig. 16 shows St. Simon (by Galopin out of St. Angela) slightly fore-shortened. Fig. 17 gives him in strict profile ; but as it had to be copied from a photograph which was not good enough to bear reproduction, its details have not come out well. They were both done in 1884, when St. Simon was a three-year-old, and when he was in training. Owing to the death of his first owner, Prince Batthyany, his nominations for the great three-year-old events were rendered void.

Despite the fact that he had never met a great race-horse, he won all his contests with such consummate ease, that I am inclined to think that as a two-year-old, towards the "back end" of the season (1883) and for the first half of his three-year-old career—in other words as long as he kept sound—he was the fastest horse, with,

Photo by] [CLARENCE HAILEY, NEWMARKET.

Fig. 418.—Lord Rosebery's Ladas, John Watts up.

perhaps, the exception of Ormonde, that ever lived. St. Simon's height at the withers, and over the croup, is considerably more than his length of body. Also, his shoulders are long and extremely oblique. I remember having been greatly struck by the marvellous beauty of his shoulders, and by the shortness of his back and loins, when I saw him for the first time, when he was sold as a two-year-old in 1883, after the death of his owner. Both his fore-hand and hind-quarters were light. He was extremely round in the back ribs, and was very well ribbed-up.

His Majesty's Persimmon (Fig. 277), who won the Derby and St. Leger, having been photographed a couple of days after he had won at Epsom, looks somewhat light, though muscular and very fit. His straight-dropped hind legs, powerful gaskins and hocks, light fore-hand, and beautifully shaped fore legs from elbow to hoof, proclaim his "quality."

Ard Patrick (Fig. 308), who won the Derby in 1902 and the Eclipse Stakes in 1903, is a particularly good type of thorough-bred from a useful point of view, as he is "well ribbed-up" (pp. 232 to 236). In fact, the greater part of the lower line of his body is parallel to the ground, in his photograph, which was taken when he was a three-year-old, and when he was in hard condition. Ard Patrick approaches the light-weight Leicestershire hunter in conformation. Ladas (Fig. 418) is essentially a race-horse.

In 1871 Hannah (Fig. 419) won the Oaks and St. Leger; and Favonius (Fig. 420), the Derby of the same year. They were in the same stable as Corisande, who won the Cesarewitch of that season carrying 7 st. 12 lbs. Lord Suffolk states, in the Badminton book on *Racing*, that Favonius was 16 or 18 lbs. better than either of the two mares; but that he became unsound. Accepting this estimation, we must regard him as one of the best horses of the past century. We might have inferred the fact of his superiority over Hannah by noting that he was much deeper in the body behind the saddle than she was, and consequently he was more of a staying type (pp. 232 to 236) than this mare. He looks up to more weight than she does, on account of his fore-arms and gaskins being more muscular, and his bones below the knee being larger. Both animals have equally "straight-dropped" hind legs. Her neck is lighter, and her shoulders appear flatter and more oblique than his.

Photo by] [FRANK HAES.

Fig. 419.—Baron Rothschild's Hannah.

Photo by] [FRANK HAES.

Fig. 420.—Baron Rothschild's Favonius.

Both have almost exactly the same proportions between the length of body and the height at the withers; and between the depth from withers to brisket, and the height of the brisket off the ground. As both were in training, and standing in nearly the same position, we have a good opportunity of comparing their respective conformation.

Cremorne (Fig. 421), by Parmesan out of Rigolboche, won the Derby of 1872 against a bad field, with the exception of the roaring Prince Charlie. His produce have been famous for their jumping powers. He is standing so awkwardly in his photograph that it is difficult to form from it a correct idea of his "make and shape." He seems to have had a long shoulder-blade and a light neck, both of which are important jumping points.

La Flêche (Fig. 422) possessed two essential points of speed, in being long on the leg and having but little to carry. By comparing Fig. 422 with Fig. 17 we shall see that La Flêche is longer in the body and not so closely "coupled" as St. Simon. She shows an inclination to "stand over" at the knees, owing to deficient development of the muscles on the front of the fore-arm (p. 281).

The Racing Pony should possess all the points of the race-horse which have been described under the preceding heading, but modified where necessary, by conditions suitable to superior ability for carrying weight; for racing ponies, in comparison to their height, have almost always to bear much heavier burdens than race-horses.

I cannot give a better illustration of a 14-hand thorough-bred racing pony of the highest class than that of Predominant (Fig. 278). He was sent from England to India, where he easily beat everything of his size in that great home of pony-racing. Mike (Fig. 279) was in a high state of excitement when he was photographed,

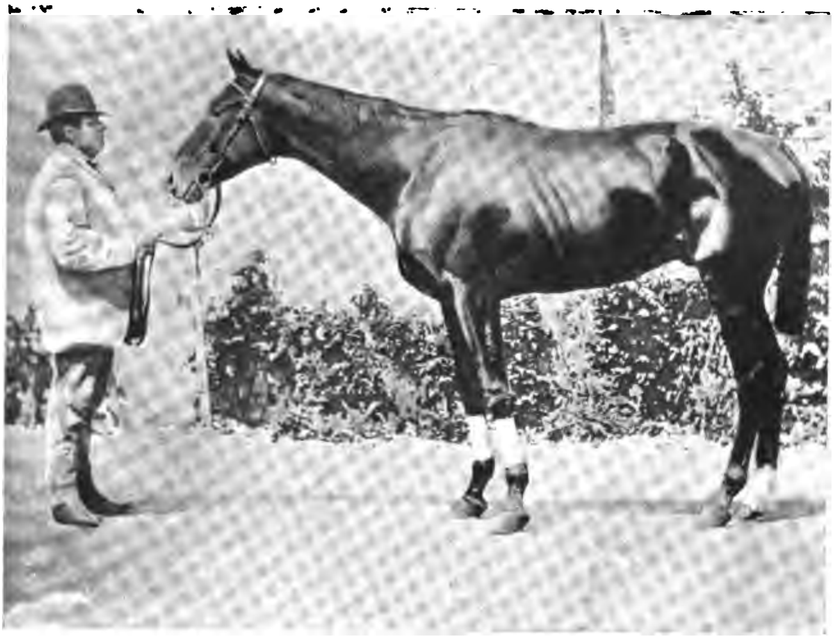

Photo by] [FRANK HAES.
Fig. 421.—Mr. H. Savile's Cremorne.

Photo by] [CLARENCE HAILEY, NEWMARKET.
Fig. 422.—Baron de Hirsch's La Flêche.

as we may see by his stiffened tail, erect head, pricked ears, and by the collected manner in which he was standing. He had capital shoulders, good legs, and, like St. Simon, had not much to carry. He was one of the best 13.1 ponies ever bred in England, and was superior to any Arab pony of the same height.

Photo by] [CLARENCE HAILEY, NEWMARKET.

Fig. 423.—Mr. H. T. Barclay's Lord Arthur.

The Hunter and Steeplechaser.—1. The fore-hand should be light. This point is of special importance in the Leicestershire hunter (Figs. 423 to 430), the goodness of whose shoulders is probably more severely tested by the ridge-and-furrow than by the jumping, which is particularly trying, owing to the fact that the animal must "spread" himself out and go fast. Many hunters which would be of no use in Leicestershire, on account of having heavy shoulders, perform brilliantly in Ireland, where jumping on and off banks, and galloping on a smooth surface do not "find out" their weak points so easily. The term "Leicestershire hunter" is

Photo by] [CLARENCE HAILEY, NEWMARKET.

Fig. 424.—Leicestershire hunter, the property of Major Muir.

applied to horses which are hunted in that county, no matter where they have been bred.

2. It is a defect in the cross-country horse to be higher at the croup than at the withers, or even to be the same height at these parts (page 174); for he requires to be light in front, and to have the bones of his fore limbs comparatively long, so as to be able to efficiently raise his fore-hand, both when taking off and landing.

3. The shoulder-blades and pasterns should be long and sloping.

4. The muscles which lie along the front portion of the shoulder-blade, and the lump of muscle above the fore-arm should be well developed; as the former straighten the shoulder joint, and the latter straighten the

Photo by] [CLARENCE HAILEY, NEWMARKET.

Fig. 425.—Leicestershire hunter, the property of Major Orr-Ewing.

elbow joint; two actions which help to prevent the horse from falling when he lands over a jump.

5. The muscles over the loins, behind the saddle, should be particularly strong (p. 67).

6. The hocks should be large; and the gaskins broad.

On page 310, I have alluded to the favour which hunting men in Ireland accord to goose-rumped hunters, and which is fully justified in practice.

A high-class Leicestershire hunter is undoubtedly the best type of horse in the world ; for he unites in himself the greatest number of useful qualities ; speed, strength, staying power, cleverness, courage, good manners and

Photo by] [CLARENCE HAILEY, NEWMARKET.

Fig. 426.—Leicestershire hunter, the property of Major de Winton.

mouth. The speed possessed by that fine steeplechaser, The Doctor, made him all the better hunter in the Shires. We may be quite certain that no horse is too fast for a Leicestershire pack of hounds which gets well away with a clear start from the field, behind a stout and straight-running fox, and with a good scent. The three horses which, to my thinking, more nearly approached in conformation the ideal Leicestershire hunter

Photo by] [M. H. H.

Fig. 427.—Mr. H. T. Barclay's Leicestershire hunter, Belgrave, by Belgrave.

Photo by] [CLARENCE HAILEY, NEWMARKET.

Fig. 428. Leicestershire hunter.

Photo by] [M. H. H.

Fig. 429.—Mr. H. T. Barclay's Leicestershire hunter, Cave.

Photo by] [M. H. H.

Fig. 430.—Mr. H. T. Barclay's Leicestershire hunter, Aquascutum, by Mackintosh.

than any others I have ever seen, were Cloister (Frontispiece), Manifesto (Fig. 431), and Liberator, all of whom were unapproachable during their respective careers. The three of them were well able to carry 15 stone to hounds, which is a task that should not be beyond the compass of the ideal animal we are considering. Gamecock (Fig. 311), another winner of the Grand

Photo by] [M. H. H.

Fig. 431.—Mr. Bulteel's Manifesto.

National, and an extraordinarily fine stayer, had all the "shape and make" of a hunter of the highest class. Midshipmite (Fig. 346), who was very smart over a country for three miles and had perfect jumping shoulders, was rather "light" in his loins and back ribs, and consequently was not a good stayer. The best middle-weight Leicestershire hunter I have seen, was Mr. H. T. Barclay's Lord Arthur (Fig. 423), who won some steeplechases, but had not speed enough to become a

Grand National winner. He possessed, in a high degree, the peculiarity, which is invaluable in a saddle-horse, of having very powerful limbs in comparison to the weight of his body (contrast the fore legs in Fig. 275 with those in Figs. 341 and 370). Specs (Fig. 342), who was honest, clever, and smart at his own distance and under a suitable weight, was built in the same way,

Photo by] [CLARENCE HAILEY, NEWMARKET.

Fig. 432.—His Majesty's Ambush II.

but had not the desirable "close coupling." Manifesto, Cloister, Gamecock, Lord Arthur, Midshipmite, and the vast majority of fine hunters and good chasers, are considerably higher at the withers than over the croup. We see this point in Fig. 433, which is a portrait of one of the best weight-carrying hunters that ever crossed the Rugby country; and in the clever and old-fashioned Irish mare, shown in Fig. 434. Franciscan (Fig. 414), who was a beautifully-shaped 15-stone hunter of very high class, was an exception to this rule. One of the nicest shaped hunters I have ever seen was Captain Williams's Joseph (Fig. 404). As examples of horses with good "middle pieces," we have Manifesto (Fig. 431), Cloister (Frontispiece), Franciscan (Fig. 414), Joseph, and Touchstone (Fig. 322). If Gamecock (Fig. 311) lacked somewhat in depth at the middle of the back, he

Photo by] [M. H. H.

Fig. 433.—Weight-carrying hunter, the property of Sir Albert Muntz.

amply made up for the deficiency by being, like St. Simon, remarkably round in the barrel.

Cloister (Frontispiece), whom I had an opportunity of carefully examining, thanks to the kindness of Mr. Duff and Sir Charles Nugent, was in two particulars a very deceptive-looking horse. The great height of the inner angle of his pelvis (p. 311) gave him a false appearance of being slack in the loins, which, in fact, were broad and muscular; and his neck was so very light that there was a marked depression between it and his shoulders (p. 269). His shoulder-blades were particularly long; although they are not very well sloped. His shoulders, though muscular, had no superfluous weight about them, as I saw by the fact that there was no undue develop-

Photo by] [A. HAYES.

Fig. 434.—Irish hunter.

ment of the "saddle muscle" (p. 270), and that his fore legs were not too far apart (pp. 247 and 248). His withers were high and thin. His fore-arms were remarkably powerful. The muscles of his limbs showed great development in comparison to the weight of his body, neck and head. His barrel was round (p. 234). He had great power of straightening his hocks, just below which the bone of the leg was singularly broad (p. 314). He showed great bone below the knee as well as below the hocks. Allowing for the scars of honourable warfare, his fore legs may be said to have been of the type shown in Fig. 358.

Manifesto (Fig. 431), who won the Grand National in 1897, carrying 11st. 3lbs., and in 1899 with 12st. 7lbs. up, is an ideal type of the thorough-bred steeplechase horse. He would certainly have accomplished still greater feats, if he had continued sound. Ambush II. (Fig. 432), another Grand National winner, does not show such good "quality" as the son of Man of War and Væ Victis, but his staying conformation (pp. 232 to 236) cannot be surpassed.

As a rule, in "The Provinces," especially where the country is cramped and there is a good deal of plough, as in Cheshire, for instance, the hunters are up to more weight and are more cobby than in Leicestershire. Fig. 322 shows a fine type, as far as conformation goes, of a Cheshire hunter, who, though strong and thick-set, had a sufficiency of speed. For a horse of his build, he had comparatively light shoulders, as we may infer from a front view of his fore-hand (Fig. 328), in that there was no undue width between his fore legs. The horse portrayed in Fig. 435, was a good heavy-weight hunter. Unfortunately, his fore legs are a good deal "mixed up" in his photograph.

Love of gambling is, no doubt, the chief cause why, among animals of equally high merit in their own respective spheres of life, race-horses and chasers are more valuable from a monetary point of view than hunters; for were it otherwise, no sane man would spend more money in the purchase of a horse to carry another man, than in that of an animal for his own riding.

The Match Trotter and Pacer.—As the best specimens of these classes of horses are to be found in

America, I shall allude to their respective conformation, when discussing American trotters and pacers.

The Heavy Cart-horse.—1. The legs should be as short and massive as possible: consequently the animal will be considerably longer in the body than he is high at the withers or at the croup, and he will be

Photo by] [M. H. H.

Fig. 435.—Weight-carrying hunter, the property of Prince Henry of Pless.

deeper from the withers to the brisket, than from the withers to the ground.

2. He should be of great width of body when viewed from behind; and across the chest in front.

3. His muscles, bones, tendons and ligaments should be as thick and strong as possible.

4. The shoulders should be sloping in cart-horses which work on rough ground; and somewhat upright in

those which toil on smooth roads, as stated on pages 78 and 276 to 278.

5. The height over the croup should be less than that at the withers (p. 78).

The Harness-horse.—For convenience sake, I use the expression "harness-horse" to signify all horses which go in draught, except heavy cart-horses and match trotters. The ordinary trapper should be thicker in the shoulders than the saddle nag; and, if he has strong hind-quarters and fair action, he may be pardoned if he be long in the back, slack in the loins, and somewhat flat-sided. For fashionable town work, the harness-horse will, as a rule, require to be either one of the smart small sort, or of the imposing brougham type. The former should have all the good looks and "quality" of a well-bred, middle-weight hack. The latter should measure high at the withers; should have sloping shoulders, so as to have free action in front; and should carry his head high. Owing to the manner in which he is bitted and "checked," his hind action is not much taken into consideration. Between these two kinds of horses, there is as much difference as between a clever bull-terrier and an overgrown, weak-loined mastiff. Fashionable trotting action is far more the result of training and selection in breeding, than of conformation. For pairs and teams, horses should match in height, colour, general character, action, manners, and mouth.

The Hack.—The chief points about the hack are that he should be "light in front," have sloping shoulders, and sound legs and feet, so that he may be sure-footed and able to stand work; and he should be rather high in front (pp. 177 and 178). The conformation of his head and neck should be such as to allow him to bend readily to the rein. The action of the hack should be somewhat "high" and should be "true," so that, when viewed from behind, the near pair of limbs, in the walk, trot and canter, should move in a line parallel to that of the off pair. Action, good looks, and a showy carriage of the head and tail are essentials in the high-priced hack.

Fig. 436.—Miss Burnaby's Butterfly.

"Mouth" and "manners" are two other indispensable requisites which do not come within the province of this book.

The Lady's Horse.—A lady's horse (Fig. 436) should be a good-looking hunter or smart hack, according to the work for which he is intended. He should carry his head and neck particularly well; because his rider, owing to the nature of her seat, cannot keep her hands low down. His fore-hand should be inclined to be high, so that his paces may be easy. His withers should not be high and thin; for if they are, they will be liable to be galled on the off side by the saddle. For obvious reasons, he should be up to at least a stone more weight than if intended for a man.

The Cavalry Trooper.—The ideal cavalry horse should (if price has not to be considered) be of the heavy weight (Fig. 433) or thick-set (Fig. 322) hunter type. His chief requirements as regards conformation are as follows:—

1. That he should be up to the weight he has got to carry, which is usually about 18 stone. But he should on no account be too heavily topped for his legs, or for the work he will be called upon to do. His loins, therefore, should be strong, his shoulder-blades long, and his legs should be as short as is compatible with the possession of sufficient speed for military purposes.

2. His legs and feet should be particularly sound and well able to stand work. As he will be called upon at times to go fast and to leap; his back tendons should be more or less parallel with the cannon bone, and he should have no tendency to undue width of fetlock (p. 282, *et seq.*).

3. His fore-hand should be light, so that his legs and feet may continue sound, and that he may be able to do his school work properly.

4. He should have a good carriage of the head and neck, so that he may be obedient to the rein.

5. He should be a "good doer," and have a strong constitution, which will usually be the case with a horse that has a bright eye; soft, cool skin; deep rounded barrel (pp. 232 to 236); full flank; firm, prominent anus; and is well ribbed up.

6. In times of peace, the height will usually vary from about 15.1 to 16 hands; but for war purposes, when endurance is of paramount importance, the height should not exceed 15.2, and may be as low as 14.1, especially if Arabs are employed.

The Officer's Charger.—A cavalry officer's first charger, with all the useful points of the cavalry trooper,

Fig. 437.—Mr. Frank St. John's Welsh charger

should have undeniably good looks, and a showy carriage of the head and tail, which should not be docked. As he will have to carry less, and will cost considerably more than an animal in the ranks, he should be well bred, and, with a rider of ordinary weight, he should approach the type of a handsome thorough-bred hunter. A second charger should have all the useful points of a first charger ; but need not be so good-looking. The colour will, as a rule, depend on regimental regulations. Speaking generally, he should not be less than 15.3, during peace time; because a man at the head of a regiment of cavalry, or of a battery of Horse or Field Artillery, looks best on a tall horse. On a campaign, the height should be the same as that advised for a cavalry trooper.

The Artillery Horse.—Artillery horses are divided into those for Horse Artillery and those for field batteries. As the teams of the former have to manœuvre with cavalry, and also drag their guns, they require to be exceptionally strong, smart horses. The latter, as they are supposed not to go faster than a trot, are stronger and slower horses than those of light cavalry. The wheelers are active, light-built cart-horses. For their work, they need to be somewhat thick in the shoulders, short on the leg, and of considerable weight to stop the gun when the order to halt is given. Their hind-quarters, loins, and hocks should, therefore, be particularly strong. The riding horses of the Nos. 1 and markers of field batteries should be of the light cavalry type.

The Mounted Infantry Horse should be of the same type as the cavalry charger, and should be about 14.2 high. Fig. 437 shows a good specimen of a remount, which did excellent service during the late Boer war. The pony in Fig. 438, though small, was of a useful kind, and also served in South Africa during 1900 and 1901.

The Light Vanner which we meet in vans, 'buses and tram-cars, should be similar in type to field artillery wheelers; in fact, active, light cart-horses that can trot freely and at fair speed.

The Polo Pony.—Handiness and speed, with sufficient staying and weight-carrying power, are the two chief requirements of the polo pony. Consequently, he should be light in front, should carry his head and neck well, have sloping shoulders, strong hocks, and his hind legs well under him. The fact of his being rather "goose-rumped" will be no detriment. These views are strengthened by the remarks made on pages 310 and 311 about the conformation of the zebra; for the polo pony, like his striped relative, requires great ability of suddenly stopping, turning round, and galloping off in the opposite direction. This turn has to be done chiefly on the hind

Photo by] [M. H. H.

Fig. 438.—English pony in South Africa.

legs, which in this case will be more or less bent, and will then have full power to project the pony in the new direction. The best English polo ponies, such as the once matchless Dynamite (Fig. 284), are animals which, but for an accident of breeding, would have been high-class hunters or brilliant chasers.

CHAPTER XXVI.

EFFECTS OF CLIMATE AND SOIL ON CONFORMATION.

Temperature—Atmospheric Moisture—Pasture—Retention of Water by Soil—Lime.

In this connection, moisture (water) comes under the heading of climate, and soil is to be regarded chiefly as a food-producing agent.

The following remarks have reference only to breeds of horses which are brought up in the open, and do not apply to those which are kept under artificial conditions.

Temperature.—Horses attain their greatest height in temperate climates, and diminish in size in cold climates and also in hot ones. In defining the limits of temperature for climates which are suitable to horses, we may roughly state that they should not be colder than the low-lying lands of Scotland, or hotter than the south of France. On this subject we cannot arrive at any sharply-defined conclusion, because the limits of temperature vary greatly in different countries.

Differences in temperature are produced as a rule by latitude or altitude, or by a combination of these two causes. As regards latitude, we find that horses bred in Finland and other parts of Northern Russia are at least a hand smaller than those of the Southern Provinces of Voronej and Poltava. The action of the Gulf Stream in raising and equalising the temperature of Great Britain and Ireland prevents us from accurately comparing the relative heights of British and

Continental horses, as regards latitude. For instance, the latitude of the Steppes of the Don is lower than that of England, but the winter temperature of the former country is at least 40° F. lower than that of the latter.

With regard to altitude, we have the well-known fact that Mountain Welsh ponies are from one to three hands smaller than Welsh ponies which are brought up on land that is from 1,000 to 2,000 nearer the level of the sea. Although the lowland Welsh ponies have been much "improved" by the introduction of new blood, they were formerly of the same breed as their mountain compatriots, but a nearly similar difference of height existed between the two. In the Shetland Islands, where the warming influence of the Gulf Stream is not so great as farther south, the combined effects of latitude and altitude in creating cold, have made an equine dwarf in the form of the ten hand Sheltie. As an instance of reduction of height produced solely by high altitude, we have the twelve hand Battak pony (Fig. 439), which is bred in Sumatra, on or close to the Equator, but on high mountains. The fact that he is largely crossed with Arab blood does not free him from the effect of his cold climate. This dwarfing influence of a high altitude is well shown by the small size of Himalayan ponies, such as those of Bhutan, Nepal and Spiti. An average fall of temperature is about 1° F. to every 300 ft. of altitude.

Cold, in diminishing height, produces this effect, chiefly in reducing the length of the limbs, but it does not decrease the animal's vigour to any appreciable extent. Thus, the afore-mentioned Finnish, Mountain Welsh, Shetland, Battak, and Himalayan ponies are short legged, hardy and strong for their size. Excess of climatic heat, on the contrary, reduces the size of the body to a much greater extent than the length of the limbs, and consequently diminishes the animal's comparative strength, as we may see in Figs. 417, 440 and 441. In fact, many Eastern ponies are longer on the leg and lighter in the body than weedy thorough-breds. This conformation being a result purely of climate, is not accompanied by a corresponding increase of speed. Fig. 442 shows an Indian Country-bred race-horse, whose English sire and dam were of fairly good "substance." Although these very leggy and light-bodied animals are allowed, like all horses bred in India, 2st. when competing against English and Australian horses on Indian race-courses, they sel[illegible] if ever win in "good company."

While the Bengal studs were in existence, the Indian Government spent large sums of money for many years in trying to breed horses for cavalry and artillery purposes, which they were able to do in that hot climate, only by the constant importation of fresh blood from England and Arabia; the breeding of Artillery wheelers being their greatest difficulty. To overcome this obstacle, the Indian Government imported many English cart stallions, the progeny of which rapidly lost their ancestral type, and turned into "country-breds," pure and simple, in a few generations. While I was in India for eighteen years, I had ample opportunities of seeing that the climate of that country has the effect of entirely altering the type of the offspring of imported horses. We see a similar result in Arabs that are bred on the Continent and in England, the Arabian type of which can be maintained only by artificial selection, and by the frequent introduction of stallions or mares that have been bred in Arabia. In this case, the chief difficulty is the well-marked tendency to increased height, which is caused by the climate being colder than that of Arabia. The relatively warmer climate of England produces a similar effect on imported Shetland ponies. The artificial conditions under which horse-breeding was conducted in the Indian Government studs, raised the average cost of the remounts to about £200. Consequently, these breeding operations were suspended, and stud-breds were replaced by Australian horses, at about a quarter the cost.

Atmospheric Moisture.—The atmosphere of all countries contains more or less moisture, the amount of which varies according to the temperature of the air, and according to the proximity of water, such as that contained in lakes, rivers, marshes and the sea. Thus, the atmosphere of Singapore is almost saturated with moisture, and that of dry inland districts of the Arctic Circ' contain a minimum quantity. Evaporation of

Fig. 439.—Battak pony, Ruby.

perspiration plays a very large part in keeping the horse's body cool during hot weather, and its rapidity varies in inverse proportion to the amount of moisture which is in the atmosphere. Hence, its cooling and health-preserving influence is more or less nullified in climates which are hot and moist. Thus we find that in the moist and warm climate of Egypt, horse-breeding is such a failure, that horses have to be largely imported, chiefly from Syria. From practical experience and from information gained from that great lover and owner of horses, the late Ali Pasha Shereef, I find that horses bred in Egypt from pure Arab sires and dams, lose a great deal of their Arab type, by becoming long-legged and weedy. In the still damper and hotter climates of Lower Bengal and those of the low-lying coasts of Southern Arabia, India, and Burma, for instance, horse-breeding is impossible from a practical point of view, because the stock produced is absolutely worthless. The ill success of the Indian Stud Department, to which I have alluded in the preceding pages, was particularly well emphasised by the fruitless attempt to breed remounts in Lower Bengal. Although the Punjab is much warmer during the "hot weather" than Lower Bengal, it produces many good remounts for the Bengal Cavalry, because its climate is particularly dry, and its soil is plentifully supplied with lime (in the form of *kunkur*), which is a subject that will be discussed on page 404 *et seq.* Horses for the Native Cavalry do not require to be such great weight-carriers as the remounts in the English Cavalry. In the Land of the Five Rivers, 115° F. in the shade is not an unusual temperature. Excellent horses are produced in the dry parts of the southern portion of Queensland, which is comparatively hot, but I am informed that even fairly useful horses cannot be raised near the coast. I also learn that it is impossible to breed such animals in the hot and damp climate of Sierra Leone.

In temperate climates, excess of atmospheric moisture has little or no bad effect on the conformation of horses, as we see in Ireland, which is an admirable horse-breeding centre, although its climate is particularly damp, owing to the proximity of the Gulf Stream. A damp condition of the atmosphere in temperate and cold climates has a well-marked influence in producing "roaring" (laryngeal paralysis), which is a disease that is very seldom met with in dry climates, or in hot climates, even when they are damp.

Pasture.—The amount of moisture in pastures upon which horses are brought up for many generations, greatly affects their conformation. Thus we find that heavy cart-horses are produced, under natural conditions, only in districts where the herbage is succulent, such as the Midlands, which is the home of the Shire horse. Saddle and light harness horses, on the contrary, thrive best on comparatively dry soil. "On very fertile clay

Photo by] [W. A. DELLA GANA.

Fig. 440.—Persian Arab pony from the Karoon Valley (14 hands).

land, the heavy cart-horse finds all the conditions necessary for building up his powerful muscular frame. He requires food which will make him massive, because he needs weight to increase his power of traction. His pace is the walk, and it is not necessary that he should be of high mettle" (*Houdaille de Railly*).

"The great height and *embonpoint* of the fen horses of Oldenburg are due to the succulency of the pastures of that country, which, like all those of marshy lands, contain a great deal of nourishment, and are much more productive of coarseness and obesity, than energy and good quality" (*A. Riguet*). "Countries which are renowned for the large size of their horses have soft and abundant herbage, which makes the animals so phlegmatic and lazy, that they can be easily kept in their enclosures by narrow drains and small fences" (*Sanson*). This well-known authority tells us that the Boulonnais, which is the best heavy draught horse in France, is a native of damp districts which produce very succulent herbage.

During all my travels I have never seen a natural breed of heavy draught horses produced on dry soil. The large majority of Russian horses are of the dry soil type, the only exception being the Beetewk, which is a heavy cart-horse that derives his name from the Beetewk river, which flows past the Voronej village of Shukavka. De Simonoff and De Moeder (*Races Chevalines*) tell us that "this breed prospered as long as the provinces of Voronej and Tambov possessed large and rich pastures; but since the greater part of these plains have become converted into arable land, the Beetewks have diminished in size, and to a great extent have lost their characteristic type, except when these animals are bred in studs by very rich agriculturists." The conditions of climate, soil, and water have made in Bretagne, as elsewhere, a fairly sharp line of distinction between its breeds of horses. Thus, on the fertile pastures near the seaside of that country, we find the heavy cart horse; on the plains of the interior, a lighter animal; and on the mountains, a pony. Like Shires and Clydesdales, the Danish, Schleswig, Dutch, Belgian, Rhenish-Prussian, Boulonnais, and Percheron breeds of cart-horses all come from countries where the pastures are luxuriant.

"When we compare the coast of Britain with those of the opposite continent, we find a striking similitude in their geological formation, and in their animal and vegetable productions. All along the British Channel, from

Land's End to the Straits of Dover, we have a country resembling, even to the indentations of the coast, the countries of France from Ushant to the Pas de Calais. Bending northward, the flat alluvial countries of the eastern coast of England correspond in the closest degree with the lowlands of Belgium and Holland. The marshes of the Zuyder Zee seem to be reproduced in the fens of Lincoln, and in both localities the horses resemble one

Photo by] [M. H. H.

Fig. 441.—Java pony mare.

another, even to the colour of the skin. Stretching again from the Humber northwards, the country in England corresponds with the Danish dominions of Holstein, Sleswick, and Jutland, and each locality produces horses tall and strong, where circumstances favour the development of their forms, of diversified colours, and differing from the great horses of the marshes; and we might pursue the parallel until we reached the granitic mountains of Norway and the Scottish Highlands" (Low's *Domesticated Animals*).

Retention of Water by Soil.—Of all soils, clay has the greatest power of retaining water, and, consequently, it is admirably suited for growing luxuriant grass. Therefore, clay land in temperate climates is the natural home of the heavy cart-horse. "Ordinary clay consists of extremely fine particles held together by a small proportion of a colloid [glue-like] body. Its constitution thus resembles that of putty, in which the particles of whiting are united by means of linseed oil" (*Warington*). This colloid body "is coagulated by salts of lime, and the action of lime on a clayfield is to cause flocculation or granulation of the particles by its action on the cementing material" (*McConnell*). The addition of organic matter, such as farm-yard manure and peat, greatly reduces the water-retaining power of clay soil, and increases that of sandy soil, which is extremely permeable. Herbage which is favourable to the development of saddle and light harness horses, is grown on comparatively porous soil.

Lime.—Lime is the oxide of calcium; and is best known in the burnt form, as "quick lime." The term, "lime," when referring to the constituents of soil, is popularly used to signify some form of limestone.

A good supply of lime in the soil is essential for the production of the herbage which is suitable to vigorous and high-mettled saddle and light harness horses. Its beneficial action is of two kinds—namely, that of helping to build up the tissues in the best possible manner, and of rendering the soil porous. Lime is derived from calcareous rocks (limestone), which chiefly consists of carbonate of lime, with which carbonate of magnesia is combined in some cases. The principal forms of limestone are: Mountain Limestone; Chalk; Magnesian Limestone, which is composed of carbonate of lime and carbonate of magnesia in varying proportions; Oolite; and Calcareous Marl, which is a mixture of clay and carbonate of lime.

The best form of limestone for the purpose in question is Mountain Limestone, which "takes its name from the fact that it occurs in various parts of the British Islands, more particularly in that range of hills known as the 'Backbone of England,' running from the Weaver Hills in Staffordshire right to the 'Borders.' It is known as Mountain Limestone, because it forms in many cases not hills but actual mountains. . . . . Although it forms

Photo by] [M. H. H.
Fig. 442.—Indian country-bred gelding, by English T.B. sire, out of English T.B. mare.

mountains in some parts, with much of the rock actually bare, yet its universal characteristic is, that though covered with a very thin, loose, rubbly soil, composed of vegetable mould and small fragments of rock, the pasture on the same is of an exceptionally sweet and nutritive character. . . . . Some special examples of Mountain Limestone farms may be given by way of illustration. For instance, in the neighbourhood of Butterton, in Staffordshire, the richest grass in that country is to be found. . . . . Again in Monmouthshire, where this rock comes to the surface, the sweetest pasture is found. In the Gower of Glamorgan, and also in Pembroke, sweet close pasture is the characteristic of this limestone. . . . . One notable point in connection with this is the quality and keeping power of the milk produced on this as compared with that from other formations. In the London milk trade it is well known that the produce of Derbyshire limestone is considerably richer in composition, and will keep from souring at least a day longer than the milk from the Essex and other clays: the lime seems to have both a productive and an antiseptic effect. This particular limestone formation passes under the great Triassic plain of Central England to appear in the picturesque hills of Derbyshire, the bluffs of the Matlocks, the scarps of Dovedale, and the high ridges of Buxton, in Yorkshire, and the basis of the famous pasturage of Craven. It is rather curious, however, to find that this formation forms the basis of the great 'Central Plain' of Ireland, whereas in England and Scotland also it occurs always in the hilly or mountain form. In Ireland it has been levelled off to form a huge plain, which is overlaid more or less now by great formations, of which the famous Bog of Allen is one of the largest and most notable examples. In the west, however, as in County Clare, the country is mountainous, the hills composed of bare limestone rock, with scarcely any soil at all. The richest herbage grows in the clefts and furrows of the rocks, and the land is worth a good rent. . . . . In other countries the grazing qualities of the Mountain Limestone soils are just as conspicuous. . . . . This limestone, in common with many of the other forms—especially the chalk—is remarkably dry and free of surface water, even in a wet climate. In the west of Ireland, for instance, there is little or no water on the surface. This is due to the fact that the rock is full of fissures, while the dissolving power of water containing carbon dioxide acting through unnumbered ages has formed caves and underground channels in which the water runs. The Derbyshire caves are examples of the former, while underground rivers are one of the peculiar features of this formation in every region where it occurs" (Primrose McConnell's *Agricultural Geology*).

Carbonate of lime, which is the chief constituent of limestone, chalk and other calcareous rocks, is practically insoluble in pure water, but readily dissolves in water that contains carbonic acid gas. Consequently, such water has a well-marked corroding action on these rocks. The atmosphere always contains a certain amount of carbonic acid gas (carbon dioxide), which is the gas that issues from a freshly opened soda-water bottle, and which is very soluble in water.

It is probable that the great porosity of limestone soil is the reason why heavy cart horses which are bred on it, very seldom retain their typical size and weight, which fact was first brought to my notice, on observing that Shire horses bred on the chalk soil of the Western portion of Norfolk, were smaller, lighter and more active than their Midland relatives.

As far as I can learn, the soil of all districts in which good saddle horses are bred, contain a large supply of lime, as for instance in Ireland, the greater portion of which is covered by Mountain Limestone. "In Kentucky, the secret of the marvellous success of breeders of the past lies alone in the soil and grasses. There is not the shadow of a doubt that the underlying limestone and the succulent blue grass are responsible for the great horses that have come from this favoured section" (*Kentucky Stock Farm*).

Lime to be efficient as a food for grass, should be in the surface soil and not in the subsoil, from which it cannot, as a rule, rise to the top, as the action of the dissolving water is to carry it more or less downwards. "It is only in the extreme North of England, in Durham, where we find a limestone region bleak and poor; but in this particular instance it is more or less due to the fact that the limestone rock is overlaid with a deep drift accumulation" (*McConnell*). Lucerne, to grow well, requires a good supply of lime, which in this case will fulfil its purpose, if it is within a short distance of the surface, although not actually in the surface soil, because the roots of this plant can penetrate to a comparatively great depth.

Plants obtain their nitrogen from the soil by means of their roots, and chiefly in the form of nitrates. In this, they are greatly aided by organisms which are in the soil, and which convert nitrogenous matter into nitrates. Vinogradski states that these nitriferous microbes cannot do their work efficiently, if carbonate of lime is not present in the soil.

We have seen (p. 22) that about two-thirds of bone consists of salts of lime.

Absence of lime in comparatively dry soil appears to have a well-marked effect in keeping down the height of horses, as we see in the ponies of Dartmoor, Exmoor, Wales and Scotland; allowing of course for the effect of climate. Although the County of Kerry (Ireland) has a comparatively warm climate, owing to its southern position and the proximity of the Gulf Stream; it produced, fifty years ago, great numbers of small ponies, which now have been "improved" into cobs or horses, in order to meet modern requirements. As far as I can remember, these Kerry ponies, many of which I rode and drove when I was a small boy, did not exceed 13 hands in height. As the soil of Kerry is chiefly Devonian, the comparative absence of lime in it was no doubt the cause of the diminutive size of the ponies. Deficiency of lime in soil also appears to reduce the size of "bone" (p. 24) of horses. Thus, the ponies of Wales, the soil of which is chiefly Silurian and Granite, are often "light below the knee," and consequently they are, as a rule, better suited for harness than for saddle. In some parts of Wales there is a good supply of lime in the soil. "Traverse the Department of Aveyron, where we find felspathic* lands deficient in lime, and calcareous districts where it is superabundant. On the felspathic lands the animals are diminutive; the men themselves are small in stature and of angular forms; their very pronunciation—who would believe it?—savours of a defect of lime. On the calcareous lands, the stature of the inhabitants is higher, their frame more powerful, and their character more loyal" (Ville's *The Perplexed Farmer*). Hugh Miller, the eminent geologist, when writing many years ago about the Sutherland evictions, tells us that "everything was stunted but men." The soil of that country is Pre-Cambrian, and consequently has but little lime in it.

In *A Naturalist's Voyage*, Darwin tells us that the lower country of the Falkland Islands, the climate of which is cold, consists of clay-slate and sandstone, and the hills are of quartz, in which geological formations, very little lime is present. Therefore, it is not surprising that he states, when referring to these islands, that "all the horses bred here, both tame and wild, are rather small-sized, though generally in good condition; and they have lost so much strength, that they are unfit to be used in taking wild cattle with the lazo. Consequently, it is necessary to go to the great expense of importing fresh horses from the Plata." Mr. McConnell tells me that the offspring of English horses which have been imported into the Falkland Islands, become stunted in growth.

Professor Cossar Ewart remarks to me "that the soil of a large area may be rich in lime, though not overlying limestone. Thousands of square miles of soil in some districts have been brought from remote limestone areas, by icebergs during the Glacial Period, and 'dumped down' at the point of stranding." For Glacial Period, see page 676. Streams can convey limestone, in a dissolved condition, to places where that rock is not present.

* Felspar is a combination of silica with oxides of aluminium and potassium (Bloxam)

The respective soils of the United States, New Zealand, New South Wales, South Australia, Queensland and Tasmania, for instance, are well supplied with lime, and produce admirable saddle and light harness horses. Lime is plentiful all over the north-west of France, except in the district near Boulogne, which is the home of the best type of French heavy cart-horse (the Boulounais, Fig. 504), and which, as we might therefore expect, has a clay soil.

Professor Warington, F.R.S., very kindly suggests to me, that, if a horse-breeder wishes to increase the amount of lime in the soil on which he raises young stock, he cannot as a rule do better than apply 5 cwts. of basic slag per acre of pasture land in November. Basic slag contains a large amount of phosphoric acid and lime, and should be used only in a very finely-pulverised condition. With respect to land deficient in lime, "it is usual to apply ten to fifteen tons of chalk, or three to nine tons of lime per acre. The land is best ploughed and then limed in autumn, and afterwards harrowed in the spring. . . . The action of the lime extends to a considerable depth, and endures for some time; it is not, however, strictly permanent, as lime is being continually removed from the soil in the drainage water." (Warington's *Physical Properties of Soil.*)

Besides lime, there are several other important constituents of soil, such as magnesia, iron, potash, and soda. Mr John Hunter, F.I.C., F.C.S., tells me that magnesia is of conspicuous importance in nitrification, and that fertility is impossible without it.

CHAPTER XXVII.

CLASSFICATION OF THE EQUIDÆ.

General Classification—Differences between Asses and Horses—Differences between Asses and Zebras—Classification of Asses—Classification of Zebras—Classification of Horses.

General Classification.—Owing to the extreme want of uniformity in the gaps left, during the process of evolution, between descendants from similar ancestors, we are unable to lay down any exact general rules for classification. The inclusion of horses, asses and zebras in the genus *Equus* admits of no controversy, because they are the only possessors of the distinguishing characteristic of having only one complete hoofed toe on each foot.

In the division of a *genus* into *species*, we are met with the difficulty that it is impossible to precisely define the meaning of the word, species; but, for the sake of convenience, we may regard a species as a group of animals which resemble each other, and which can produce fertile offspring more or less similar to themselves or to their ancestors. Buffon's remark that fecundity "is the only characteristic which differentiates or identifies species" is not of general application,* although it serves our purpose in the case of horses and asses, by enabling us to place these respective animals in two different species. Up to the present, experimental research has not solved the question as to the fertility of offspring which could

* Although the mule and hinny are sterile, we find that the offspring of some parents (such as the ox and bison, and also the dog and wolf) which are much more dissimilar than the horse and ass, are fertile. The dog is supposed to be descended, partly from the wolf, and partly from the jackal.

be produced by the inter-crossing of zebras and asses, and of different kinds of zebras, and of different kinds of asses. This further classification is therefore purely theoretical, which is a remark that also applies to any present distinction made between the domestic horse and Prjevalsky's horse (p. 640).

When some members of a species possess hereditary characteristics which distinguish them in a well-marked manner from the other members of their species, we are justified in considering that they belong to a distinct *variety*. Darwin rightly remarks that "I look at the term species as one arbitrarily given for the sake of convenience to a set of individuals closely resembling each other, and that it does not essentially differ from the term variety, which is given to less distinct and more fluctuating forms."

The distinctive characteristics which belong to the members of a species or of a variety, are the natural result of evolution, in which climate, soil and enemies are the chief factors in the case of the Equidæ. Among domesticated animals, artificial selection and artificial conditions produce new types, which are termed *breeds*.

Differences Between Asses and Horses.—Some of the following differences between asses and horses are relative; and others absolute. Most of these differences also exist between zebras and horses.

1. The ass has, practically speaking, chestnuts only on the fore legs, which is a peculiarity that is met with in certain breeds of horses (p. 319). In some cases, the ass has vestiges of chestnuts on his hind legs. The chestnuts and ergots (p. 319) of the ass are much thinner than those of the horse.

2. The ass has a tufted tail, somewhat like that of an ox, an erect mane, and no forelock. The horse, with the exception of the Prjevalsky wild horse (p. 640), has a bushy tail, drooping mane, and a forelock, when they have been

allowed to grow. The difference in the mane is due to the length of the hairs of the part. In almost all breeds of horses, the hairs of the tail grow long from the root of the dock. In the ass, they do so only as they approach the end of the dock.

3. As a rule, the ass has five loin vertebræ, and the horse six (p. 422). I have never heard of an instance, in

Fig. 443.—Off fore foot of donkey.

the domestic ass, of the number of these bones exceeding five. I believe that the normal number in zebras is five. If, however, we examine the skeleton of the Mountain Zebra which is in the Museum of the R.C.S. Lincoln's Inn Fields, we shall see that it has six loin vertebræ. The number of these bones is subject to variation in all vertebrates.

4. In the horse, the lachrymal duct, which is the canal that conveys tears from the eye on each respective side

into the nostril, has its opening near the inferior commissure of the nostril, and on the line of union between the dark-coloured skin and the pink mucous membrane. In the ass and mule, it is situated at the inner face of the outer wing of the nostril. This orifice is sometimes double.

5. In the ass, the false nostril extends higher up than in the horse.

6. The male ass has two rudimental teats in the form of small tubercles. They are usually absent in the horse.

7. The vocal sounds of the ass (braying) are produced in a different manner from those of the horse (neighing). Mr. Della Gana, F.R.C.V.S., Veterinary Adviser to H.I.M. The Shah of Persia, tells me that the Persians keep large numbers of donkeys. If these asses cause annoyance by being vociferous, the owners effectively stop the braying by lubricating the anus, externally and internally, with butter or other forms of grease. We may, therefore, conclude that braying can be performed only during strong contraction of the muscles of the abdomen and chest. It is evident that this muscular contraction is not required in the neighing of the horse.

8. In the ass, the deep depression at the base of the epiglottis is covered by a thin membrane, which is capable of vibrating, and which is wanting in the horse. It may have some influence in causing the voice of the ass to differ from that of the horse. The epiglottis is a cartilage that acts as a door to the larynx, which is the organ of voice, and which forms an opening into the windpipe.

9. The ass hardly ever has any irregular markings on its coat, such as a "star," "blaze," "reach," or "stockings," all of which are very frequent among horses. A small star, on one or two occasions, is the only mark of the kind I have ever seen in the ass, of which animal I I have not had much experience.

10. I believe I am correct in saying that the colour of the ass is never of a bright bay, chestnut, red or blue roan, or nutmeg grey. I have seen mules of an iron-grey colour ;

but have not observed it in the ass. This conservatism in colour and freedom from irregular markings, shown by the ass, is very remarkable ; considering how greatly the coat of the horse varies in this respect, and that the ass has, in all probability, been longer under the influence of domestication than the horse.

11. The ass is higher over the croup, than at the withers, which is a peculiarity that tends to make his withers appear unduly low (p. 241). The spines of the vertebræ

Fig. 444.—Side view of incisors of a 4 year-old horse (nat. size).

at the withers are only a little shorter in the ass than they are in the horse. As a rule, horses are higher at the withers than they are at the croup.

12. The horse's dock is thicker, stronger and shorter than that of the ass.

13. The horse, on each side of his croup and covering his pelvis, has, underneath and closely adhering to the skin of the part, a thick and extremely dense layer of connective tissue, which is so close and hard, that it looks like horn, when the skin has been tanned and dried. These two patches of thickened skin are separated from each

other about four or five inches apart, so that there is a strip of skin of ordinary thickness running down the croup towards the tail. These pieces of skin are utilised, chiefly, for the manufacture of long boots for foreign cavalry officers, by curriers, who dress and pare down the "shell," or hardened layer, until it is almost as smooth as glass, and can consequently take the brilliant polish which is greatly esteemed by these *beaux sabreurs*. I need hardly say that the leather which is thus employed, is worn inside out. It is both air and water tight. The "shell" is connected to the skin so closely that the two form one piece; although their respective consistencies are different. If a section be made through the hide, their line of union may be readily seen. In the ass, the "shell" is not confined to the skin that covers the pelvis; but also extends over the ribs, which are consequently not as sensitive to the effects of blows as are those of the horse. The tendency which horses and asses have to turn their rump, as the least sensitive part of their anatomy, towards falling rain, cold currents of wind, etc., appears to be due to the feeling of protection to that part, which the presence of the "shell" on each side gives them.

14. The ass has no tufts of hair at the fetlocks (p. 290).

15. Messrs. Tegetmeier and Sutherland appear to have been the first to note the difference between the respective periods of gestation of asses and horses; the former period being twelve months; the latter, eleven months

16. The foot of the horse is more highly specialized than that of the ass. One of the best-marked evolutionary changes in the equine foot, was the gradual curtailment of its posterior bearing surface (frog and sole), until, in the horse (Fig. 382), the length of this bearing surface is not much greater than its width, and is included between the heels and the "toe" of the hoof. In the ass, this bearing surface is relatively longer than in the horse, and extends some distance beyond the heels to the rear (Fig. 443). Also, the shape of the foot of the ass, from

above downwards, is more or less cylindrical; and that of the horse is more or less in the form of a truncated cone.

Fig. 445.—Side view of incisors of a 14 year-old horse (nat. size).

Fig. 446.—Front view of incisors of a 14 year-old horse (nat. size).

17. The teeth of the horse are more highly specialized than those of the ass. A valuable and well-known factor

in determining the age of horses, especially those which have lost their "mark," is the gradual diminution in the angle which the upper and lower permanent incisors make with each other, as we can see by comparing Fig. 444 with Fig. 445. In Fig. 444, which represents the mouth of a four-year-old horse, the angle made by the posterior edges of the two 2nd incisors of the left side, is about 180°. The gradual diminution in the acuteness of this angle is due to the continued lengthening of the crowns of the incisors, and to the peculiar shape of the bony sockets (alveoli) in which these teeth are set. As the gain in length, by elongation of the crowns is greater than the loss in length, by wear; this arrangement of the incisors helps to obviate any dental inconvenience which might arise from excessive growth. We can see in Fig. 643, that the gradual lengthening of the crowns of the molar teeth is a well-marked feature in equine evolution; and from a study of the mechanism of equine dentition, we learn, that for purposes of food-prehension and mastication, the growth of the incisors must be proportionate to that of the molars. Hence we may assume that the crowns of the incisors, like those of the molars, have gradually lengthened during the evolution of the horse; and consequently, that the acuteness of the angle made by the upper and lower incisors of the horse of today, increases with age, to a greater extent than it did in the case of his ancestors. On turning to the domestic ass, we find that in old donkeys (Figs. 448, 449 and 450), the angle in question is greater than in horses of similar ages (Figs. 445, 446 and 447). Consequently we may infer that the teeth of the domestic ass are of an older type than those of the horse. Also, the incisors of the donkey are relatively narrower than those of the horse.

Differences between Asses and Zebras.—The tiger-like stripes on the neck and body (hence the name *Hippotigris*) are perhaps the only distinctive difference between zebras and asses in general. The fact, as pointed out by Professor Ewart, that the true Burchell's zebra has a well-developed 1st premolar (p. 49) on each side of the upper jaw, may probably come under this heading. The stripes, as pointed out by Messrs. Tegetmeier and Sutherland (*Horses, Asses, Zebras, and Mules*), are not a good generic distinction, because all the Equidæ are occasionally

Fig. 447.—Tables of incisors of a 14 year-old horse (nat. size).

more or less marked in this manner. Even in individual cases of zebras, the nature of the stripes is subject, more or less, to variation, and they are seldom uniform on both sides of the body. The stripes on the neck are continued through the hairs of the mane.

Classification of Asses.—Some naturalists divide asses into two species, namely, the African Wild Ass, and the Asiatic Wild Ass; and divide the former into two varieties (the Nubian Wild Ass and the Somaliland Wild Ass); and the latter, into three varieties (Onager, Kiang and Syrian Wild Ass). Domesticity for many thousands of years has produced so little effect in altering the distinctive markings of the Nubian Wild Ass, in the case of its domestic relative (the common donkey), that it is reasonable to regard the Nubian Wild Ass and the Somaliland Wild Ass as two separate species. The Onager, Kiang and Syrian Wild Ass do not, respectively, possess characteristics sufficiently well-marked or sufficiently permanent to warrant their being placed in separate species. We may therefore class them as varieties of one species (*Equus hemionus*).

Classification of Zebras. — Naturalists generally divide zebras into three species, namely, the Mountain zebra, Burchell's zebra and Grévy's zebra; and class Chapman's zebra, Grant's zebra and Crawshay's zebra as varieties of Burchell's zebra.

Classification of Horses.—The group of horses which presents the best marked differences from other horses, is Prjevalsky's horse. The characteristics of this wild Mongolian animal (p. 640 *et seq.*) are distinctive enough to place him in, at least, a separate variety. If it is found that offspring produced by intercrossing with Prjevalsky's horse and the domestic horse are sterile, we shall naturally regard them as hybrids, and shall class Prjevalsky's horse as a separate species. Although this wild animal is usually regarded as intermediate between the horse and ass, he is certainly more closely allied to the former than to the latter. The idea entertained by some zoologists that Prjevalsky's horse is a hybrid produced by crossing the kiang with Mongolian mares, has been conclusively refuted by Professor Ewart, who bred on his experimental farm near Penicuik, several hybrids of this kind, all of which were essentially different from

Fig. 448.—Side view of incisors of a 14 year-old donkey (nat. size).

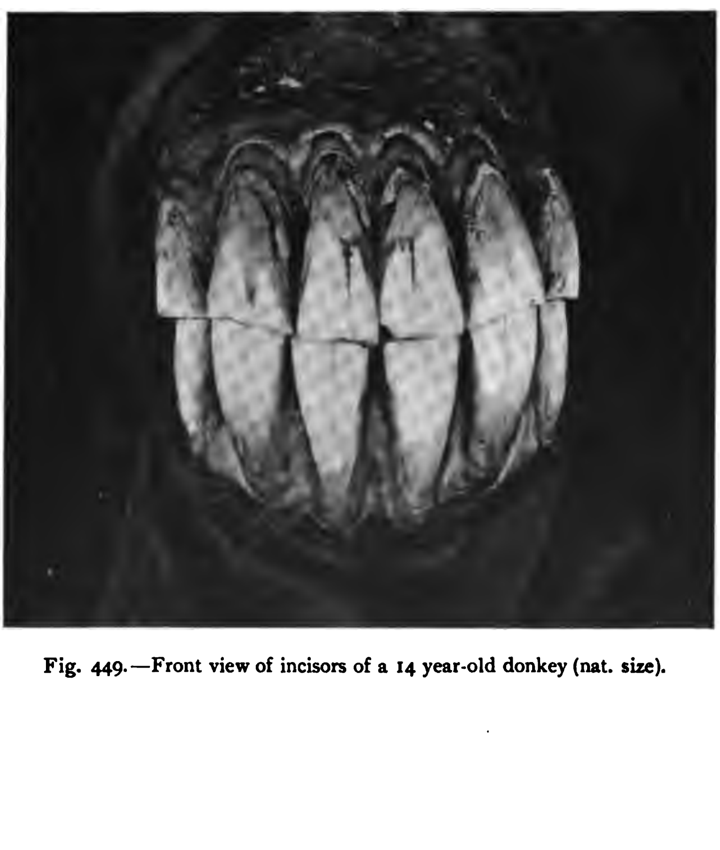

Fig. 449.—Front view of incisors of a 14 year-old donkey (nat. size).

Prjevalsky's horse. One of these, a kiang-Exmoor-mare hybrid, among other differences, brayed like his asinine sire, and had no chestnuts (p. 319) on his hind legs. Prjevalsky's horse, on the contrary, neighs like the domestic horse, and has relatively longer chestnuts on his posterior limbs. Also, his mode of living (p. 641) conclusively shows that he is not a hybrid. As the zoological name of the domestic horse is *Equus caballus*, the best designation for Prjevalsky's horse, with our present defective knowledge, is probably *Equus caballus, prjevalskii*. It appears that the Tarpan (p. 648) is or was a variety of *Equus caballus*.

In passing from varieties to breeds, we again encounter the difficulty of drawing distinctions, which, in this case, are not clearly enough defined to be absolute. As far as I can learn, no attempt has been made to separate ponies from horses, except on the purely artificial basis of height, which is of an extremely variable nature, as we have seen in the preceding chapter. Sanson regards the North African horse as a special variety, and calls this animal *Equus caballus africanus*. In support of this view, he avers that this horse has only five lumbar vertebræ, instead of the usual six; and that it has no chestnuts on its hind legs. This attempted distinction with regard to the number of the loin vertebræ is not valid, because we not unfrequently find only five loin vertebræ in other breeds, as for instance, in the case of the famous thoroughbred, Orlando, whose skeleton is in the Museum of the R.C.S., Lincoln's Inn Fields. Salensky tells us that Prjevalsky's horse has only five loin vertebræ. Struthers (*Jour. Anat. Phys.*), Bateson (*Materials for the Study of Variation*) and other biologists have shown that in all vertebrate animals, man included, the number of loin vertebræ is subject to variation. The absence of chestnuts in the hind legs is not confined to the North African horse. Professor Ewart has shown that both ergots and hind chestnuts are often absent in the ponies of Iceland, Faroe Islands, Hebrides and Connemara. On visiting Crabbet Park Stud, by the kind permission of Mr. Blunt, I examined 14 of his pure bred Arabs, and found that 4 of them had no ergots, either before or behind; that 3 had ergots behind, but not in front; and that 7 had ergots before and behind. I have also found ergots absent in thorough-breds. It is probable that the respective possessors of the peculiarities in question, inherited them

Fig. 450. — Tables of incisors of a 14 year-old donkey (nat. size).

from wild ancestors, in which they were distinctive characteristics; but domestication has been such a potent factor in breaking up equine varieties, that we cannot regard all the members of a "breed," to be descended from the same primitive type, although a certain percentage of them may have a common origin.

As Prjevalsky's horse has only five loin vertebræ, he may be in the same line of descent as Sanson's *Equus caballus africanus*. I have seen many Barbs (which are North African horses) with chestnuts on their hind legs.

A breed is an actual, not a theoretical, collection of individuals, which may, or may not, have a common origin. Hence, it is not correct to apply the term breed to particular members of one or more breeds, on the ground that such members are, respectively, possessors of distinctive characteristics. Professor Ewart most reasonably points out that descendants of two or more separate equine varieties may exist in the same breed, and that, in ancient days (presumably in Pre-glacial times), there was an equine variety without ergots and hind chestnuts, and another variety with these callosities; the former being certainly of a newer type than the latter.

Retzius, the Swedish anthropologist, divided mankind into brachycephalic (short-headed) and dolichocephalic (long-headed) varieties; this classification* being made with reference to the proportion between the transverse and longitudinal diameters of the skull. Many zoologists apply this form of classification to horses; and speak of some breeds of horses as having big heads, and of others as having small heads. In doing this, they usually appear to compare the size of a horse's head with his height, and consequently they call a thorough-bred, a small-headed horse; and a Shire, a big-headed horse. Here we must take into account the fact that the height of an ordinary horse is chiefly dependent on the length of his legs, which is of a very variable nature. I have found that the proportion between the length of a horse's head and that of his body (pp. 184 and 186) is practically the same in all the many breeds of domesticated horses which I have examined in Europe, Asia and Africa, and that the length of the head is about equal to the depth of the

* Lord Avebury states that "we class those skulls in which the relation of the breadth to the length is less than 73 to 100, as long heads or dolichocephalic; those in which it is from 74—79 to 100 as medium heads, and those in which the proportion is 80 or more than 80 to 100 as short heads, or brachycephalic." West African Negroes are said to be dolichocephalic; and Europeans, brachycephalic.

body at the lowest point of the back. Consequently, I regard the proportion between the size of the head of these respective horses and that of their body as more or less uniform. As the far greater size of the body makes the body a much more useful means of comparison than the head, it is more advisable, as a rule, to employ the expression large-bodied or heavy-bodied, than big-headed; and small-bodied or light-bodied, than small-headed. This form of classification is generally used by practical horsemen.

The subject of the size of a horse's head in comparison to that of his body, needs further research, because Professor Ewart tells me that those ponies of Iceland, Hebrides and Faroe Islands which have no hind chestnuts, have relatively small heads, and that those which have these callosities, have relatively large heads. Also, the head of Prjevalsky's horse (pp. 643 and 644) is relatively larger than that of any other member of the horse family.

From the foregoing remarks we may conclude, that no breed of horses possesses any distinctive characteristic which serves to distinguish it from other breeds, although separate varieties may exist in any particular breed. As a rule, locality (climate and soil, see preceding chapter), and artificial selection are the chief factors in the formation of breeds.

CHAPTER XXVIII.

BRITISH AND IRISH HORSES.

The Thorough-bred—Half-bred Horses—The Shire Horse—The Suffolk Horse—The Hackney—The Cleveland Bay—The Yorkshire Coach-horse—The Exmoor Pony—The Dartmoor Pony—The New Forest Pony—Welsh Ponies and Horses—The Clydesdale—The Athole Garron—The Shetland Pony—Hebridean Ponies—The West Highland Pony—Irish Horses and Ponies.

The Thorough-bred.—The distinguishing qualities of any specialized breed of domesticated animals depend on the particular purpose for which it is bred, as we can see in the case of the thorough-bred, American trotter, Hackney, Shire Horse, greyhound, foxhound, merino sheep, and Berkshire pig, all of which have been submitted to artificial selection for many generations. On referring to the *Racing Calendar* of last year (1902), we find that the number of horses of different ages which ran during that season was as follows :

Two-year-olds	1,351
Three-year-olds	1,070
Four-year-olds	647
Five-year-olds	352
Six-year-olds	189
Seven and upwards	221
Total	3,830

The relatively large number of two and three-year-olds which compete on the Turf, is the result of the numerous racing prizes that are respectively reserved for these two classes, the owners of which naturally desire to have a quick return for their money. With these inducements, breeders of racehorses, like breeders of Shorthorns, have been successful in obtaining early maturity by selection during many years. "Young meat may perhaps nourish the human body as well as the flesh of the more matured animal does, and there may be no harm in forcing meat in order to bring it early into the market; but forced and exhausting work to bring the horse at two years old to the starting-post, is a very different affair, and ought not to find favour with the true lover of the horse. It is not the union of the qualities of form, strength, endurance and speed that is sought by the present system; but the single quality of momentary speed in the immature horse, to which everything else is subordinated" (*Ker B. Hamilton*).

As racehorses take their age from the first of January, and as the racing season begins shortly after the middle of March, early foaling is a very important factor in the artificial development of the two-year-old, which is the most numerous member of his class. With respect to this method of "forcing," I cannot do better than to quote the following remarks made by Mr. John Porter in *Kingsclere*, on this subject; because, as a trainer, he can have no sentimental prejudice, in desiring to curtail the extent of two-year-old racing: "The three most unfavourable months in the year in which foals can be born are January, February, and March, inasmuch as the young things have to contend with the very worst weather which we experience during the whole course of the year. Mares and foals must be housed, and can only be turned out during rare intervals of sunshine, when the foal naturally gallops about, becomes very hot, afterwards stands shivering by its mother's side, gets a chill, and thereby sows the seeds of roaring and other diseases which cling to the animal through the rest of its life. Again, for the first three months of the year the mares must be fed on dry food with a linseed mash, and occasionally a few carrots for a change. I doubt whether this kind of feeding admits of the mare nourishing her foal as she would do if she broused on the natural grasses that spring up in April and May. I do not believe that early foaling occurs naturally among horses running wild, and I maintain that in our endeavours to breed good early foals, we are fighting a battle with Nature and getting the worst of it. In the whole of my experience I doubt whether I have ever known a May foal that was a roarer." In all animals, hereditary predisposition to early maturity obtained by artificial selection is accompanied more or less by constitutional weakness, as we see by the frequency of tuberculosis in Shorthorns. In the large majority of cases, roaring (*Laryngeal paralysis*) is transmitted only by thorough-breds, and is practically unknown among pony breeds. Early training for racing is a prolific cause of unsoundness, especially in two-year-olds; the injuries in question being chiefly sore-shins, and sprains of the ligaments and tendons of the fore legs. Also, the practice of allowing roarers to race is not only cruel, on account of the distress in breathing which it causes them; but it is also a potent factor in the propagation of this serious and incurable disease.

A Derby winner is of necessity an animal which possesses the "gift" of early maturity, though probably not to as great an extent as a Brocklesby Stakes' winner. An English racehorse does not usually attain his highest state of excellence at a later age than four years, as we may see by the frequent use of the expression, "four and upwards," in the conditions of "All-aged" races. This early maturity is generally followed by early decay, as we learn from the fact (p. 426) that only 221 horses out of the 3,830 runners of last year, were over six years of age. Many years' experience of racing in India has shown me that Arabs which are used at racing, rarely become fully developed before they are eight or nine years old, and until they have been raced for two or three seasons. Many of these horses are better at twenty, than they were at five years of age. Arabs are not subjected to the deteriorating influence of artificial selection for early maturity.

The following table, which is taken from the *Racing Calendar*, shows the number of races of different distances during the season of 1902 :

Five furlongs and under six	697
Six furlongs and under one mile	349
One mile	339
Over a mile and under two	515
Two miles and under three	88
Three miles and under four	3
Four miles	1
Total	1,992

As more than half these races were under one mile and over six furlongs, we may regard seven furlongs as the distance over which the majority of our racehorses can best perform. As the average weight which the winners carried in these races was 8st. 6lbs., we may consider it to be about the weight which the average winner can carry. The majority of the losers are evidently not up to such a ponderous burden.

From the foregoing statistics, we learn that two distinguishing qualities of the English thorough-bred are great speed with a light weight, over a short distance; and early maturity. We have already seen that the conformation for speed is the opposite to that for strength. Hence, if we require an increase of strength in the thorough-bred, we can obtain it only with a diminution of speed; and *vice versâ*. A third and very important quality is special suitability for riding purposes, within reasonable limits of weight. Variation and reversion, as in all other forms of evolution, play a large part in the conformation of the thorough-bred. Consequently, we occasionally find thorough-bred horses which are good light-weight hunters, and great steeplechase horses, such as Manifesto, The

Colonel, Emblem and Emblematic; and others which revert to "vulgar" ancestors, such as the mare shown in Fig. 305. As speed is the chief point taken into consideration by breeders for the Turf, the vast majority of thorough-breds show great deficiency of ability to carry weight and to "stay." It is generally estimated that out of every 2,000 horses bred for the Turf, only about three attain pre-eminence for speed, strength, staying power, and pluck. The faulty manner in which many thorough-breds are raised purely for sale purposes, also lowers the quality of this class. Mr. John Porter makes the following remarks on this subject, and on the baneful practice of putting yearlings into work and "trying" them before they are two years old :

"How is it that, proportionately, private breeders produce more winners than are turned out by public breeders? The answer is that the former allow their yearlings to gallop about the paddock until they pass into the trainer's hands, while the latter are, by force of circumstances, obliged to pamper and feed up their yearlings to show well in the sale ring. It is only natural for the breeder for sale to take excessive care of his yearlings, which for a month or prior to their being sold, are led about at a walking pace an hour or two every day, and are seldom if ever permitted to go loose in a good gallop; consequently, they pass from the ring to the trainer full of soft, unhealthy fat, instead of being covered with hard muscle. Again, there are owners, and trainers as well, who are anxious to discover whether they have secured a gem; or they want to know something about the yearling before the first Tuesday in January, when entries have to be made or minor forfeits declared for stakes already closed. Therefore, yearlings in the condition described—with their long coats, and, in short, with everything against them—are put into active work over heavy ground. I believe that hundreds of horses are permanently ruined by such pernicious premature training. As to the time for the declaration of minor forfeits, I consider it most ridiculous that January and February should be selected for the purpose. April would be a much more suitable month. If we could gradually alter our dates, the age of the horse from January 1 to March 1, and our two-year-old racing from March 25 to May 1, we should, I feel sure, be taking an important step in the right direction, and sounder, stouter, and better animals would be the result. Far too much encouragement is given to two-year-old racing by adding such large sums of money to the stakes. It would be better for the sport and more conducive to the improvement of blood stock, if a large proportion of these enormous sums were given to competitions for older horses, and therefore for races of greater length than five or six furlongs."

All hunting men know that good thorough-bred hunters perform brilliantly, especially on the grass lands of the Shires, and "do well," if they are carefully tended by the stud groom and his strappers, and are not asked, as a rule, to hunt oftener than three days in a fortnight; but we cannot get over the fact that they are unable to stand continued hard work and "short commons," as well as the ordinary half-bred hunter. On the subject of the constitutional strength of "blood" horses, Mr. A. B. Paterson, who is a well-known horse expert, gives us valuable practical information in *The Sydney Mail*, of 15th March, 1902. He tells us that the best lot of horses that left Australia for South Africa, during the late war, were "police horses sent over by the Government, and 50 per cent. of them were fit to exhibit in any show ring in Australia. They were a magnificent lot of animals, and for one day's gallop they would have distanced any other lot of horses at the front. They were the best lot of horses in Africa, but they did not last long. Their high-strung nerves and eager dispositions made them inclined to fret and refuse their food, and after a long march it was the usual thing to see many of our horses refusing to eat the poor feeds set before them. They were too high class to stand hardships and misery.

"It is an article of faith with most horsey men that a well-bred horse will do anything that a commoner can do, but as a matter of fact, if a drover is going out on a trip involving a certain amount of starvation for his horses, he would not take well-bred horses in expectation that they would last the longest. He would take half-bred Arab ponies, or some such hardy breed. . . . . A big thorough-bred (or nearly thorough-bred) bay mare, given me by Mr. E. R. White of Denman, was one of the finest animals at the front, and the surrendered Boers were often asking her price as a brood mare, but she began to fail and to refuse her food after a month's work, so she was purchased by the Prince of Teck to be used as a show charger."

We can see from the foregoing statistics and remarks that, in the ordinary thorough-bred, strength, endurance, and constitution is sacrificed for early maturity, and speed over a short distance. If the T. B. yearling shows lack of speed at "the back end of the year," he is often sold for £10 or £15, and is not unfrequently sent to do work between the shafts of a Hansom cab, in drawing which, there will be little or no weight on his back. This animal is therefore a highly specialized racing machine, and, as a rule, is of but small value from a useful point of view. To make him serviceable as a hunter, hack and remount, two-year-old racing would have to be abolished, the weights raised, and the length of the courses increased, and roarers precluded from racing. If this remedy was put into force, the thorough-bred would not only gain in strength and endurance, but would also retain his health and vigour to a much later period than he does at present, as we may see by comparing the table given on page 426, with the following one, which shows the number of horses that won steeplechases during the season of 1902; the average weight being 11st. 7lbs.:

Four-year-olds.	182
Five-year-olds.	213
Six-year-olds	261
Seven and upwards.	551
Total	1,207

This table shows us that our best steeplechasers do not mature at an early period, and we all know that they last at their work much longer than race-horses, and far fewer of them are "musical." Here the factor of castration comes into play ; but practically all the racing Arabs in India (p. 428) are entire, and yet they retain their form to a very late period.

In 1802, races of two, three and four mile heats were common, and the following table gives the number of horses of different ages which ran during that season :

Two-year-olds	31
Three-year-olds.	117
Four-year-olds	108
Five and upwards	280
Total	536

To conclude this subject, I give the following quotation from Mr. John Porter's book : "I am convinced that horses would last quite as long on the Turf, running races from one up to two miles, as they do now continually running five furlongs. The strain on them would not be half as great as is the pillar-to-post driving to which they are now subjected. Poor horses ! How sick they must get of it ! One cannot wonder that so many run 'shifty,' considering that they are kept in such a state of irritation from the moment the jockeys are mounted until they have passed the winning-post. And such races are ruinous to the riding of the jockeys. Indeed, there is no riding, properly speaking, in it. . . . . . When a few years ago, I first gave expression to some of the foregoing views, I remarked how much more sport and how much more pleasure one has in watching a long race ridden by such jockeys as Tom Cannon, John Osborne, Webb, and Watts, who know the pace they are going, and can nurse and get a horse home, even if they have a little the worst of it. . . . . . I am quite as sure now as I was then—surer, perhaps—that if we had later foals, less two-year-old racing, and longer races, we should have better horses, better trainers, and better jockeys."

Half-bred Horses.—The ill-defined term, "half-bred," signifies a horse which has more or less thorough-bred blood in him, but which is not eligible to have his name entered in the *General Stud Book*. As a rule, the best half-breds are made into hunters, and the remainder figure as carriage horses, remounts, and general utility animals. The large majority of the best polo ponies have at least three-quarters thorough-bred blood in them.

We learn from the experimental researches of scientific men like Darwin and Ewart, and from the practical experiences of ordinary breeders, that the offspring of a sire and dam of different breeds may (1) resemble one of its parents; may (2) resemble both parents in varying proportions; may (3) resemble an ancestor; may (4) combine parental and ancestral characters in varying proportions; or may (5) develop new characters, with or without parental or ancestral characters. From this we see that the more apart, as regards type, a mated stallion and mare are, the more uncertain will be the nature of the physical and mental characters of the future offspring. As the ordinary thorough-bred (p. 426 *et seq.*) is the possessor of great speed, but of little strength, it has, in order to produce a foal of the hunter class, to be mated as a rule with an animal which is too heavy for hunting, and which is liable to transmit the cart-horse, and not the "cross-country" kind of conformation. In the field, a hunter with a cart strain will usually communicate the secret

Photo by] [C. REID, WISHAW.

Fig. 451.—Mr. Joseph Wainright's Shire Stallion, Bury Victor Chief.

Photo by] [J. DELTON, PARIS.

Fig. 452.—Heavy-draught Danish Stallion.

of his birth to his rider, by his rough style of going, on account of his fore-hand being unduly heavy. Even with a thorough-bred sire or dam of the hunter class, the offspring will have a strong tendency to resemble, in one or more fatal respects, the ordinary seven-furlong race-horse, because its parent was a wide variation from the typical thorough-bred. If flat racing was abolished in favour of steeple-chasing, without diminishing the weights and distances, it would be possible in time to breed hunters and remounts of a far better and more uniform type than we can now do. The great point about obtaining uniformity of type in breeding, is to have sire and dam of similar conformation. At present, the breeding of half-breds is a lottery, in which the percentage of prizes is small.

The Shire Horse.—The immense weight of the Shire horse makes him the *beau ideal* animal for very heavy draught on smooth roads; but it more or less unfits him for agricultural work, as has been explained on pages 76 and 77. Also, his lack of speed, even at a walk, is a very serious drawback in this respect. In the case of farmers in the Midlands, these objections are more than counterbalanced by the high prices obtained for young and promising Shire horses, especially as clay land is the best on which to breed them (p. 401 *et seq.*). The Shire horse has obtained his name from his native home, the Shires; and "has been distributed for centuries through the district between the Humber and the Cam, occupying the rich fen lands of Lincolnshire and Cambridgeshire, and extending Westward through the counties of Huntingdon, Northampton, Leicester, Nottingham, Derby, Norfolk and Stafford, on to the Severn. It has also been extensively bred in the low-lying pasture lands of England, in the counties both North and South of these named, everywhere retaining its typical character subject to slight variations produced by differences of climate, soil and food" (*Sir Walter Gilbey*).

Photo by] [C. REID, WISHAW.
Fig. 453.—Mr. Horace Wolton's Suffolk Stallion, Chieftain's Champion.

Photo by] [C. REID, WISHAW.
Fig. 454.—The Duke of Hamilton's Suffolk Mare, Queen of Trumps.

Within late years, the Shire Horse Society has done much to specialise this breed, and to increase its soundness. The best Shire horses stand about 16.2 to 17.1, and they must have a great deal of long, fine hair ("feather") below the knees and hocks. The most esteemed colours are bay, brown and black, with white "stockings," which is a fashionable though foolish (p. 337) fad. Formerly the Black Lincolnshire horse was a well known variety of the Shire horse, but that colour is now rarer than bay and brown. Grey is not unfrequent, and chestnut is usually looked upon as a sign of "softness." The artificial conditions under which Shire horses have been developed within late years, have naturally decreased their hardihood to some extent. Figs. 11, 274, 282, 403, 416 and 451 show typical specimens of Shire horses.

"There is no reason to doubt that the Fens and Midlands produced large horses at the time of Cæsar, as well as did the Low Countries (with which there was much intercommunication even in those early days, from the fact that some of the British tribes were Belgians), because there is great similarity in the geological and physical features of the two regions. Cæsar was much struck with the appearance of the horses in the army of Cassivelaunus as being superior to those he was accustomed to see. Now the curious fact is that Cassivelaunus was the chief of the tribe called Catieuchlani, occupying the district now comprising Cambridge, Northampton, Rutland and Leicester shires, and forming a big slice of the country in which the large horses originated" (*Mc Connell*).

In the middle ages, many Flemish and North German horses were imported for crossing with the English Great Horse or Black Horse, as he was then called; but as the new arrivals were practically of the same origin as their English mates, no great change of type could have been effected by this intercrossing. The heavy draught Danish horse (Fig. 452), which comes from the same source as the Dutch and Belgian cart-horse, would pass as a Shire,

Photo by] [M. H. H.

Fig. 455.—Old-fashioned Roadster.

Photo by] [M. H. H.

Fig. 456.—Roadster.

if his legs were furnished with an abundance of "feather," which has been obtained by artificial selection.

The Great Horse was much employed as a cavalry remount in the days when the military man and his horse were protected by heavy armour. After the introduction of fire-arms, armour was discarded, and a lighter and faster horse took the place of the Great Horse in our army.

Photo by] [C. A. TADMAN, STANSTED, ESSEX.

Fig. 457.—Sir Walter Gilbey's Hackney Stallion, Hedon Squire.

The artificial evolution of the heavy cart-horse does not appear to have commenced before the middle of the eighteenth century. "The pack horse was the chief means of burden bearing, whether in the conveyance of goods to market or of conveying friends from place to place. As to the conveyance of goods, we find that as late as 1789 even the farmers were only gradually getting on wheels. A few carts were in use, no waggons, and the bulk of the transit in many districts was by means of pack horses. In the colliery districts, coal was carried by horses from the mines; even manure was carried on to the land in some places on the backs of horses! Trusses of hay were also occasionally met with loaded upon horses' backs, and in towns, builders' horses might be seen bending under a heavy load of brick, stone, and lime. Members

Photo by] [C. A. TADMAN, STANSTED, ESSEX.

Fig. 458.—Sir Walter Gilbey's Hackney Stallion, Royal Danegelt.

of Parliament travelled to London on horseback, with long overalls or wide riding breeches, into which their coat tails were tucked to be kept from the mud of the highways" (*Live Stock Journal*). The weight of the heavy cart-horse increased more or less in proportion to the improvement in roads, especially after the advent of Macadam; and of late years has received an additional rise from fashionable requirements at Shows.

The Suffolk Horse (Figs. 453 and 454), which was formerly called the Suffolk Punch, is our most typical agricultural horse, and is a distinctive chestnut breed that has been in existence for the last two hundred years, if not longer. Unlike the Shire and Clydesdale, he carries little or no superfluous hair on his legs. Respecting his

Photo by] [C. REID, WISHAW.

Fig. 459.—Sir Walter Gilbey's Hackney Stallion, Danegelt.

merits, I cannot do better than give the following quotations :—

"Of the three great breeds of heavy-weight horses, the Suffolk is the handiest and the most active, whether at plough or on the road, while his pluck at a dead pull is extraordinary. As a heavy vanner, where speed is required as well as endurance and strength, the Suffolk especially shines. Then he is very thrifty ; a poor Suffolk is almost as rare as a dead donkey, as his great girth and lung room lay the foundation for a hardy constitution" (*Farmers' Advocate, Canada*). "What the Suffolk breeder aims at and the judge in the ring likes best, is a horse 16¼ hands high, with great width fore and aft; deep in the rib from elbow to flank, with a back like a Southdown ram and no diminution in width forward of the hips: short legs and hard feet, a good swinging walk and well

Photo by] [H. R. GIBBS, KINGSLAND ROAD.

Fig. 460.—Sir Walter Gilbey's Hackney Mare, Lady Keyingham.

balanced movement all round. The graceful outline is rarely absent, for the plain head, the ewe neck and drooped rump are no features of the Suffolk horse. Long muscular shoulders widening out at the point from a front view; great width over the hips and massive quarters are the distinguishing points in the show horse at home" (*Sir Cuthbert Quilter*).

The conformation which is most suitable to endurance and which has been described on pages 232 to 236, is a well-marked characteristic of the Suffolk horse. His indomitable courage at a dead pull, is evidently a gift he has inherited from his ancestors, who, long ago, were frequently used in "Drawing Matches" against each other. His ability to stand hardship and scanty fare, is much greater than that of our other breeds of cart-horses. Formerly, the Suffolk horse was rather inclined to be unsound in his legs and feet, but that infirmity is now supposed to have been weeded out. The only fault I can find in him, is that he is rather light below the knee, in comparison to his girth. A fairly large number of Suffolk horses are annually exported to the Continent, America and Australia, in all of which countries they are held in high repute.

The Hackney.—We have seen (p. 440) that carts were but little used up to the end of the eighteenth century, owing to the badness or absence of roads. At that time, the Hackney was essentially a riding horse which could gallop, trot and stay. Fast trotting was a characteristic of the Norfolk Hackney (Norfolk Trotter). We read in the *Sporting Magazine* of 1803, that a "chestnut Hackney mare, a descendant of Staring Tom, was matched to go from the Market Cross, Chichester, to the 15-mile-stone on the Portsmouth road, and back again three times, making 90 miles, in 9 hours, allowing the animal for rest and refreshment three hours. She went the first 30 miles in two hours and fifteen minutes; after one hour and three-quarters' rest she performed the second 30 miles in two hours and twenty minutes; was started again the third time, completing the task in six hours and forty-five minutes, which was two hours and a quarter within the time named. This performance shows the mare did the 90 miles at the rate of a little over 14 miles an hour. It was two years previous to the above, in July, 1800, that the celebrated Hackney mare, Phenomenon, was backed to trot 17 miles in 56 minutes for a bet of £400, which she did in 53 minutes." Bellfounder (p. 569), who was able to trot 17 miles in an hour with 14 stone up, was a Norfolk trotter that did much to establish the hereditary gift of trotting in American horses. At the time of Bell-

Photo by] [C. A. TADMAN, STANSTED, ESSEX.
Fig. 461.—Mare and foal, the property of Sir Walter Gilbey.

founder, match trotters were saddle, not harness horses. With improvements in roads, later on, the Hackney was also used in harness, and he was then a riding and driving horse of high merit, from a useful point of view, and somewhat similar in type to the horse shown in Fig. 455, which, to my thinking, looks a pre-eminently serviceable roadster for country requirements in England. I leave my readers to examine his good points; and to aid them in this respect, I give, by way of contrast, Fig. 456, in which the horse is very much of the same class; but differs greatly in slope of shoulder, length of neck, and shape of head. Subsequently, the Hackney was largely crossed with the thorough-bred, with the result that the Show Hackney of the present day in some cases (Fig. 457) resembles the old-timer; and in others (Fig. 458), the race-horse.

Danegelt (Fig. 459) was a handsome and typical Hackney that possessed the valuable quality of being able to transmit, to a remarkable extent, his best points to his offspring. In Ganymede (Fig. 338), he left behind him a worthy son of the highest character. In Figs. 460 and 461 are shown high-class Hackney mares. The two distinct breeds which were formerly known as the Norfolk trotter and Yorkshire Hackney are now merged into the one class of "Hackney."

The fashionable height of the Hackney is about 15.2½; and the useful height, from about 14.2 to 15.1. A greater height than 15.2 can rarely be obtained without sacrificing type. The usual colour is chestnut, and next come bay and brown. Black is rarely seen in this breed. It is an interesting fact that chestnut Hackneys are generally better shaped and have more brilliant action than Hackneys of other colours; and consequently they form the large majority of winners at shows. This success of the chestnut colour is not always continued in the Sale Ring, because purchasers of harness horses usually prefer bay or brown, and as a rule they like the animal to be at least 16 hands high. Therefore, colour and height are often serious market objections against Hackneys, especially in competition with German harness horses.

As the present Hackney has been artificially evolved into a showy, high-stepping light-carriage horse; his conformation is not well adapted to saddle work, especially that of the present day. Of late years, hacking has steadily decreased in popularity, except perhaps in the Row, and practically the only civilian saddle horse is the hunter, which, besides being able to carry a rider "on the flat," must have a conformation suitable to jumping, which is a form of movement that has no place in the

Photo by] [C. REID, WISHAW.

Fig. 462.—Mr. H. C. Stephens' Cleveland Stallion, Luck's All.

artificial evolution of the Hackney. The unpopularity of hacking is well proved by the fact that, even in the Midlands, it is a rare occurrence to meet anyone, except grooms at exercise, hacking during the non-hunting season. At that time, the fashionable hunting people of the Shires much prefer to bike or to go in a motor car, than to ride. The artificial conditions under which the modern Hackney has been developed, have naturally unfitted him to successfully bear privation, hard work and severe climatic exposure for a long period, which a good remount would have to do. The Hackney, which is a particularly brilliant light-harness horse for show purposes, would perform his duties fairly well as a fashionable hack, but he has no claim to be a high-class hunter or enduring Army horse. Also, he cannot be regarded as a fast trotter, according to the American standard of

Photo by] [C. REID, WISHAW.

Fig. 463.—Mr. H. C. Stephens' Cleveland mare, Madam.

two minutes thirty seconds for one mile. The stars of the "Harness Turf" belong to the 2.10 list.

The Cleveland Bay (Figs. 462 and 463) has existed as a distinct type for hundreds of years in the North and East Ridings of Yorkshire; and was known in early times as the Chapman Horse. Formerly, he was used for coaching and agriculture, at both of which he was an equally great success. In ancient days, the roads were so bad and the vehicles were so heavy, that strength rather than speed was sought for in coaching. At farm work, the Cleveland has always distinguished himself by his great activity. With improvements in roads and carriages, breeders of Clevelands have successfully tried to obtain more speed by crossing with the thorough-bred. The Cleveland of to-day, is essentially a clean-legged coach

Photo by] [M. MIDGLEY, YORK.

Fig. 464.—Mr. John White's Yorkshire coach stallion, Captain Sykes.

horse or light vanner, with blood-like head, full, well-arched neck, sloping though rather thick shoulders (suitable for a collar), and well set-on tail. His good carriage of head, neck and tail makes him a showy harness-horse. He has a tendency to be light in the loins, which fact, along with his comparatively heavy fore-hand, unfits him, as a rule, for saddle work. The mare stands about 16 hands; the stallion, 16.1 to 16.2. The only recognised colour is bay. The action, at a trot, resembles that of a thorough-bred, and is free from " the snap of the knee " of the Hackney. At this pace, the Cleveland bends his hocks well, and brings his hind legs under him with great freedom. Tradition points to a Barb cross with Yorkshire cart mares as the foundation of this breed, which at present is not in a very prosperous state.

Photo by [M. MIDGLEY, YORK.
Fig. 465.—Mr. John White's Yorkshire coach mare, Ainsty Queen.

The Yorkshire Coach Horse (Figs. 464, 465 and 466).—The increase of speed rendered necessary by improved communications, showed the advisability of an infusion of Eastern, and subsequently of thorough-bred blood, into the Cleveland, with the result of the formation of the Yorkshire Coach Horse, which may now be regarded as a distinct type. For detailed information on this subject, readers would do well to consult Vol. I. of *The Yorkshire Coach Horse Stud Book*, which tells us, as regards the speed and endurance of these animals, that

" Dreadnaught, by Old Clothier, won a trotting match for £100, carrying 16 stone, 16 miles within the hour; and that Peirson's Plato trotted 18 miles within the hour, carrying 18 stone."

The Exmoor Pony is a very old breed, the typical colour of which is brown or dark bay, with black

Photo by] [PINK, YORK.

Fig. 466.—Yorkshire coach horse.

points and a light tan-coloured muzzle. Greys are occasionally seen, but there are practically no chestnuts. Lord Arthur Cecil, who has had great experience among ponies, especially those of the south of England, tells me that " Exmoors may be roughly divided into two sections, namely, those of Sir Thomas Acland's breeding, and ordinary Exmoors. Sir Thomas Acland's Exmoors are very nearly the perfection of the pony type, having lean, wiry-looking heads, small lively ears, a most undaunted outlook in their eyes, fair shoulders, strong hind-quarters, and the best of feet and legs. They are all cast in the same mould, and if used on other breeds, are extraordinary impressive. Succeeding proprietors have made it a point to keep the height below 12.2, under the impression that the land cannot support those of a greater height. I am inclined to think that it is best to let the land decide the

Photo by] [HAYMAN & SON.

Fig. 467.—Mr. Edward Mucklow, Junr.'s Exmoor pony stallion, Royal Oak.

size which it can carry; provided that no weediness is allowed to creep in. The breeders of the other variety of Exmoors have rushed to the opposite extreme, and by introducing alien blood, have sacrificed type to some extent."

Sir Thomas Acland (*Live Stock Journal*, 28th May, 1886) states that his father, prior to 1815, had about 500 Exmoor ponies running wild on Exmoor, and that a famous and possibly mythical stallion, Katerfelto, was supposed to have infused some fine Spanish or Arab blood into them. He also informs us that Exmoor ponies are miniature cart-horses, with good action, and that they have goose rumps.

Mr. Charles H. Basset, late Master of the Devon and Somerset Staghounds, writing to Mr. Edward Mucklow, jun., thinks that there is no breed of pony like the pure

Photo by] [HAYMAN & SON.

Fig. 468.—Mr. Edward Mucklow, Junr.'s Exmoor pony mare, Gladys.

Exmoor, of which Sir Thomas Acland and Mr. William Westacott, of Harkridge, are the principal breeders. Mr. Basset says that "these ponies are beautifully shouldered, deep-girthed, and with lovely heads; but with the drooping quarters peculiar to the breed, and which I have been told, are generally seen on all horses and ponies that are bred and reared on hilly and mountainous land. Anyhow, both the ponies and sheep of Exmoor have the same sloping hind-quarters." Writing to me about Exmoor ponies, Mr.

Mucklow says that "they are the foundation of the best polo ponies, mated with a thorough-bred horse, not too big. Ponies bred this way are extraordinary jumpers, and lovely hacks."

Royal Oak (Fig. 467) and Gladys (Fig. 468) are handsome specimens of this breed.

The Dartmoor Pony (Fig. 469) stands about

Photo by] [C. REID, WISHAW.

Fig. 469.—Dartmoor pony, Goldfinder.

13 hands high, and somewhat resembles the Exmoor pony. It is probable that in days gone by, little or no difference existed between these two breeds; but the introduction of various kinds of alien blood has made this animal more or less a nondescript. Lord Arthur Cecil tells me that "they are hardy, sure-footed, clever and useful ponies which can stand any amount of work, and are essentially of the general-purpose type. The most esteemed colours are brown, bay and black."

The New Forest Pony (Figs. 470 and 471) is an old English breed that has been much crossed. They are hardy, clever and good-tempered, and are useful either in saddle or harness. Lord Arthur Cecil, who has done admirable work in improving this breed, writes to me about it as follows :—" In 1890, I went to the New Forest, and found that for many years few if any stallions

Photo by] [C. REID, WISHAW.

Fig. 470.—New Forest pony stallion, the property of Lord Arthur Cecil.

of the true old breed had been kept. There is no doubt that owing to the laws of Henry VIII., New Forest ponies had been bred bigger than any of the other southern native breeds, and the height attained was probably too great for the land. It must, however, be borne in mind that when these laws were enacted, the best land in the Forest was open to commoners. Such land is now occupied by plantations, and cattle and horses are excluded, with the result that only the barest and most unproductive parts are left for these animals to feed on. It has been the custom to sell off the Forest everything that would fetch the most money, and consequently nothing but the worst animals were left to be bred from. Hence, decrepit and weakly stallions were allowed to run amongst their mothers and sisters, and to gradually deteriorate the race. As far as I could ascertain, the old type, when

Photo by] [C. REID, WISHAW.
Fig. 471.—New Forest pony mare and foal, the property of Lord Arthur Cecil.

it appeared, was singularly like the Exmoor, in the wonderfully sharp outlook, clean head and bright eyes, and also, singularly enough, the tanned muzzle and flanks. I tried the experiment of bringing a few Exmoors into the Forest, and everyone of the old commoners were unanimous (not knowing them to be Exmoors) in saying: 'Ah! that was the old kind of pony which lived in the Forest.' It seemed to me clear that the best thing to do, was to infuse plenty of fresh blood into the stock, and for the last eight or nine years I have been turning from 20 to 30 stallions out in the Forest, and certainly with no loss of type. The Forest pony is now in good condition, and is extremely hardy. There are about 2,500 mares in the Forest, and to do them well, about 100 stallions are annually required."

Welsh Ponies and Horses.—These animals belong

Fig. 472.—Welsh mountain pony.

to a very old breed which has been evolved under conditions of hardship, exposure, and rough and mountainous ground. Hence they are particularly hardy, enduring, sure-footed, and often clever jumpers. They may be classified as follows:

1. *Welsh mountain ponies* (Fig. 472).—Mr. Percy Dugdale of Llwyn, Llanfyllin, who is a large breeder of this class, tells me that these ponies rarely exceed 11.2 in height. Their small stature is evidently the result of the cold climate

of their mountain homes. The term "improved" Welsh mountain pony (Fig. 473), is applied to Welsh mountain ponies which have been crossed with other blood, in order to obtain more height or better quality.

2. *Ordinary Welsh ponies*, which being bred on lower ground, are from one to three hands taller than their mountain relations.

3. *Welsh cobs* (Fig. 437), which vary in height from 14 to 15 hands.

Photo by] [M. H. H.

Fig. 473.—Mr. Percy Dugdale's "Improved" Welsh mountain pony.

All these animals have been more or less crossed with alien blood.

Formerly there was a breed of Welsh cart-horses, but it is now practically extinct.

The colour is usually bay or brown.

In the days when the Norfolk Hackney was a hard-working roadster and fast trotter, several of its class were brought into Wales and crossed with the native ponies. Consequently we find that many Welsh ponies and cobs have the gift of trotting, which, in their case, is generally united with strength and endurance. Having sat behind many of them, I certainly think that they are the most useful trappers of a small size in the United Kingdom. Crossing them with the present-day Hackney would naturally diminish their utility, although it might enhance their value from a fashionable point of view.

The Clydesdale is a distinct breed of heavy cart-

Photo by] [C. Reid, Wishaw.

Fig. 474.—Mr. P. Crawford's Clydesdale stallion, Prince of Carruchan.

horse that has been long established in Scotland. He is, as we may see from the fine specimens shown in Figs. 474, 475, 476 and 477, a remarkably handsome, strong and active animal. Clydesdale breeders, as a rule, make a great point in obtaining oblique shoulders and sloping pasterns, and seek for ability to walk fast and trot well, with as much strength as possible. The breed has been crossed a good deal with the Shire. Scotch breeders will no doubt keep the Shire type in their minds; for weight means money in the cart-horse market.

The Athole Garron is a remarkably strong and hardy type of the pack horse, and is well represented by the specimens (Figs. 320 and 478), which I had the pleasure of photographing when visiting Blair Atholl.

Photo by] [C. REID, WISHAW.
Fig. 475.—Mr. R. H. Walker's Clydesdale mare, Zeynab.

The old breed is becoming scarce from crossing, chiefly with Clydesdales, in which attempt to gain height, there is a corresponding decrease of utility. The usual height is about 14.2. They are now bred chiefly by the Duke of Atholl.

"Argus," writing in *The Live Stock Journal,* tells us that "as to their very early history little is known, save that, as in Glenorchy, they were improved from time to time by importations of Spanish, Barb and Arab stallions. James IV. of Scotland, who fell at Flodden, sent his grooms into Spain, about the commencement of the sixteenth century, for stallions, and Louis XII. of France sent him as a present a choice collection of the best French breeds. In 1535 James V. passed an Act of Parliament for increasing the size of Scottish horses, and more particularly those of the ancient Royal forests, of which Athole is one of the oldest. The weight to be carried to the hill is very

Photo by] [C. REID, WISHAW.
Fig. 476.—Lord Londonderry's 4-year-old Clydesdale stallion, Holyrood.

rarely under 16 or 17 stone, and the garrons have often to finish the last ten miles home of a full thirty miles journey with an 18-stone dead stag on their backs. They are if anything a little short in the neck to make comfortable saddle hacks, but for hill work they have no equals, as there really is no tiring them out. All are hill reared and brought up on rough hill pasture, scarcely any of them knowing anything of oats."

The Irish word, *garron*, has the same derivation as the

Gaelic word, *gearran*, and in olden times meant a strong horse or sturdy hack. It is now applied only to worthless horses or ponies.

The Shetland Pony (Figs. 282, 321, and 479) has its home in the Shetland Islands, which are to the north-east of Scotland, and are about 360 geographical

Photo by] [C. REID, WISHAW.

Fig. 477.—Mr. John Gilmour's Clydesdale mare, Moss Rose.

miles distant from the Arctic circle. It usually stands from 9 hands to 10.2, which is the limit of height, according to the *Shetland Pony Stud Book*. The Sheltie appears to have been smaller formerly than he is now, for Youatt, writing seventy years ago, says that this pony "is very diminutive; sometimes not more than seven hands and a half in height, and rarely exceeding nine and a half. . . . These ponies possess immense strength for their size; will fatten upon almost anything; and are prefectly docile.

Photo by] [M. H. H.

Fig. 478.—Duke of Atholl's Highland Garron mare.

Photo by] [C. Reid, Wishaw.

Fig. 479.—Lord Londonderry's Shetland pony, Laird of Noss.

One of them, nine hands in height, carried a man of 12 stone 40 miles in one day." The colour varies a good deal, and is usually bay, brown or black. Shelties are generally employed either for pit-work, or for children to ride or drive.

M. A. C. H. (*Country Life*, 7th March, 1903) says that the country of the Shetland Islands "is distinctly

Photo by] [G. A. EWART.

Fig. 480.—Barra (Hebridean) pony.

hilly, but none of the hills are of any great height. They are covered with stunted heather and grass, which afford grazing of a scanty description for the ponies and sheep belonging to the inhabitants.

"There seems to be no exact record as to when the Shetland pony appeared in the islands, so it is not known whether it was introduced by the early inhabitants, or later by the Norse settlers. That the horse existed in the islands before the Norsemen came is probable, as there

Photo by] [G. A. EWART.

Fig. 481.—Barra (Hebridean) pony.

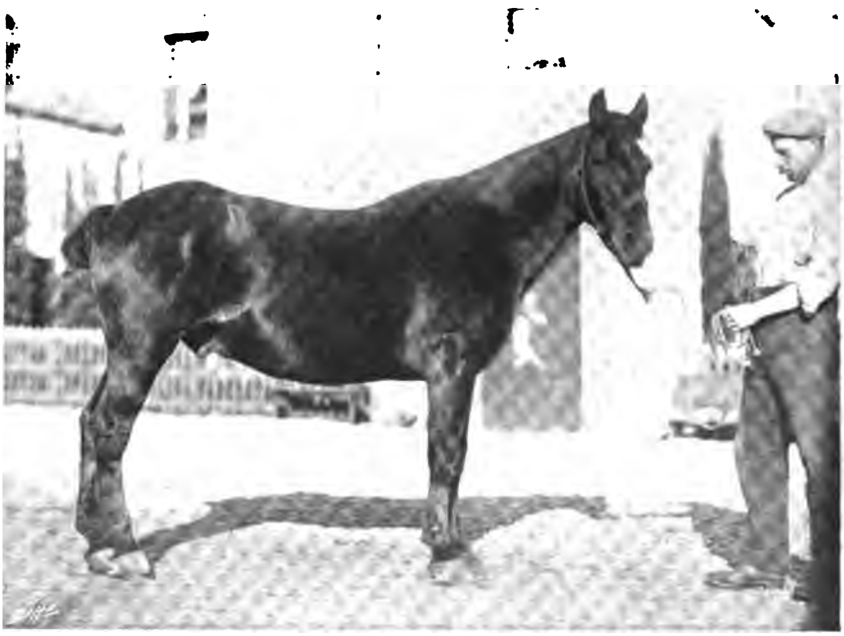

Photo by] [G. A. EWART.

Fig. 482.—Skye pony.

is preserved in the Edinburgh Museum an ancient Celtic stone, which was discovered in the Isle of Bressay, bearing, amongst other pictures of various objects, an excellent representation of a horse, on which a man is mounted. As the horse is certainly the most lifelike of all subjects carved on the stone, it can be safely conjectured that the early inhabitants must have known the animal well in order to depict it so faithfully.

Photo by] [C. REID, WISHAW.

Fig. 483.—Lord Arthur Cecil's West Highland pony, Highland Laddie.

"The first authentic record we have of such ponies existing in Shetland is from Brand, the historian, who wrote about the islands in 1700. He says: 'They have a sort of little horses, called Shelties, than which no other are to be had, if not brought hither, and from other places. They are of a less size than the Orkney horses, for some will be but nine, others ten, nives or hand-breadths high, and they will be thought big horses there if eleven, and although so small, yet are they full of vigour and life, and some, not so high as others, often prove to be the strongest. Yea, there are some whom an able man can lift up in his arms, yet will they carry him, and a woman behind him, eight miles forward and as many back! Summer or winter they never come into an house, but run upon the mountains in some places in flocks.'

Photo by] [M. H. H.

Fig. 484.—Mare by a Hackney sire, out of an Irish hunter dam.

"The keeping of the breed small enough seems now the chief difficulty which breeders in England and more southern climes have to contend with, and it is only by the most judicious selection and mating that this difficulty is overcome. Breeders in other parts have also frequently to introduce ponies born and bred in their native islands, or else undoubtedly the ponies, surrounded with more genial circumstances, and provided with richer and more plentiful feeding, would grow much larger in time. The principal object in breeding this very small class of ponies is for work in the coal-mines, as a larger pony could not move freely in the narrow passages and low-roofed seams. The great relative strength of the Sheltie also makes him peculiarly desirable for this purpose, and for good ponies good prices can always be obtained in the mining districts in the north of England. Shetland ponies live to a great age, and retain their good looks in a wonderful way."

Hebridean Ponies (Figs. 283, 480 and 481) vary a good deal in height. Those of Barra usually stand from 11 to 12 hands high; but those of the larger islands, like Skye ponies (Fig. 482), are often from 13 to 14 hands high. They are strong, hardy, and good workers; and frequently resemble Iceland ponies, to which, in all probability, they are nearly related. It is interesting to note that in early days, Scotland and its islands were connected with Iceland and Scandinavia. The pony shown in Fig. 481, was a particularly good specimen of his breed.

The West Highland Pony (Fig. 483) is a Scottish breed of great hardiness and strength.

Irish Horses and Ponies.—The credit which Ireland has long possessed, of being an admirable country for breeding saddle horses, is, in a great measure, due to the fact that a large part of its low-lying soil has been formed from mountain limestone (p. 406). Although the majority of the best hunters in England come from Ireland, heavy cart-horse breeding is almost an unknown quantity in the Emerald Isle, owing to the dearth of luxuriant clay pastures (401 *et seq.*). In some parts of the north of Ireland, the Hackney cross with hunters has been tried, with fair results as regards the production of harness horses. Fig. 484 shows an Irish-bred Hackney-hunter mare which I took to Russia for sale, and which became the hack of an Arch-Duchess. This mare walked and trotted in superb style, as if the whole world belonged to her; but she was very rough at the canter, and had no idea of galloping. These imperfections receive but little notice in the Land of the White Czar, because the Russian nobility, both male and female, prefer show to speed, when on horse-back.

Photo by] [M. H. H.

Fig. 485.—Professor Ewart's yellow dun Connemara pony mare and foal.

Fifty years ago, good hardy ponies (like those of Kerry) could be easily obtained in Ireland; but since then, ponies have become scarce in the Old Country, and have been more or less replaced by a miserable class of donkeys.

The Connemara Pony (Fig. 485) still remains. It stands from 13 to 14 hands high, and is strong, hardy, and clever.

CHAPTER XXIX.

COLONIAL HORSES.

Australasian Horses—Canadian Horses—South African Horses.

Australasian Horses.—This term includes the horses of Australia, Tasmania and New Zealand.

Between the years 1864 and 1890, I had a long and intimate acquaintance in India with these horses, many scores of which I owned, trained, raced and steeplechased. As I have seen very few Australasian horses since that time, I shall limit my remarks to those of a by-gone period. In those days, many of the horses (about 3,000) annually imported into India from Australia and New Zealand were of an admirable saddle type, and were distinguished by their excellent flat shoulders, light necks, well-shaped legs, sound feet, and ability to jump cleverly. At that time, the Antipodes appeared more suitable for the production of thorough-breds with large bone and substance than the United Kingdom, because a comparatively large number of animals of the hunter and charger type, which had little or no stain in their pedigrees, came from these colonies. Although, as a rule, their fore-hands were lighter and their shoulders better than those of our half-bred horses, their head, loins, barrel and croup were not so well shaped. The fault of being a bit "three-cornered" was more apparent in Australian than in New Zealand horses. Owing to the comparative absence of cart blood, they did not make such good Field Artillery wheelers or vanners, as English horses. These Colonial horses had the great advantage of being brought up on extensive and comparatively dry "runs."

Australasian race-horses at long distances were probably as good as any horses in the world. The performance of Carbine (a New Zealand son of Musket), in winning the Melbourne Cup, two miles, with 10 st. 5 lbs. up, compares not unfavourably with the most brilliant vic-

Photo by] [M. H. H.

Fig. 486.—Mr. A. A. Apcar's Australian horse, Bravo.

tories of Ormonde, Isonomy, or St. Gatien. In the Colonies there were many smart racing ponies, like Glengary II., Little Wonder (New Zealand), Mayflower, and Jeannette; but they were not as good as the best in England and Ireland.

The Australian race-horse, Bravo (Fig. 486), by Grand Flaneur out of The Orphan, won the Melbourne Cup in 1889, when in receipt of 21 lbs. from Carbine. When I took his photograph, he was about half-trained, and was consequently somewhat lusty. To judge of him as he was standing for his portrait, he appears to have been a trifle longer in the body than he was high at the withers, from which fact we might infer that he was not a race-horse of the highest class. He had good shoulders, long neck, short back, and good depth at the centre of his back, and was consequently a fine stayer. His hocks were not as straight as those of Ormonde (Frontispiece), Persimmon (Fig. 277), or St. Simon (Figs. 16 and 17).

Photo by] [M. H. H.

Fig. 487.—Mr. Vansittart's Australian gelding, Romance.

Romance (Fig. 487) was a handsome Australian horse of the middle-weight hunter or charger type. He won several races over hurdles and on the flat in Australia and India; but among inferior company. His shortness of leg, as compared to his length of body, precludes the possibility of his being gifted with a fine turn of speed. Though no race-horse, he was perfectly shaped as a fast hunter. He had a short back, long " rein," and particularly strong, well-formed legs. His good shoulders and light head and neck were valuable jumping and galloping "points." His best points of speed were, no doubt, his straight hocks and powerful gaskins.

The horse shown in Fig. 488 belonged to a common type of under-bred Australian horse, which made a good remount and useful slave. As a rule, these horses are well fitted for saddle work; for their fore-hand is comparatively light and their legs good.

Photo by] [M. H. H.

Fig. 488.—Under-bred Australian gelding.

We can see excellent specimens of the present day Australasian horses in Figs. 245, 246, 247, 248, 255, 288, 325, 343, 489, 490, 491, 492, and 493.

As far as I can make out, New Zealand saddle-horses are more akin to the English and Irish type, than those of Australia.

I have great admiration for the jumping powers of Australasian horses, and can speak from practical experience on this subject, as I won steeplechases on good ones, such as Jovial, Rebecca, Brown Duchess and Objection.

Mr. H. W. Grimani-Smith, who is a Manager of Stations for the Queensland Investment and Land Mortgage Company, and is a well recognised authority on Australian horses, has most kindly given me the following notes on these animals.

Photo by] [THE GRESHAM STUDIO, ADELAIDE, S. AUSTRALIA.

Fig. 489.—Mr. Hope Murray's Lubra.

"Horses, not being indigenous in Australia, were imported into that country from various parts of the world. In the early days of settlement, many mares were brought over from South America, and are supposed to have introduced the vice of buck-jumping, which has made timid riders regard the Australian horse with a good deal of suspicion.

"Emigrant, a thorough-bred English horse, was imported by Admiral (then Captain) Rous, when he was stationed in the Australian waters; and 'Rous's Emigrant' appears in the pedigrees of many of the best Australian horses. Some good Arabs were imported from India, and one of them, a grey named Satellite, was a famous sire of useful horses. Several of his stock performed gallantly, when carrying the police on their arduous duties in those days. When 'the diggings broke out,' horse-breeding

Photo by] [THE GRESHAM STUDIO, ADELAIDE, S. AUSTRALIA.

Fig. 490.—Mr. Hope Murray's Lubra jumping 6 ft.

suffered a relapse, because many of the 'hands' on the 'stations' where stock were raised, rushed off to the mines, and as the means of transport were at a premium, all kinds of horses fetched fancy prices. Since those days, things have improved, and many thorough-bred horses and mares of the highest class have been imported into Australia and New Zealand with the best results, as regards the breeding of race-horses. Grandmaster, by

Gladiateur, though useless on the Turf, was most successful at the stud, and got winners over all distances. Unfortunately, three of his best sons (Highborn, who was well known in India; Paris, who raced in England as Paris III.; and Bungebah) were geldings, and their excellence will die with them. The best thing that ever happened to the Colonial Turf, was the New Zealand Stud Company's importation of Musket, who was bred by Lord Glasgow. This horse was the sire of many winners, some of which were of the highest class, such as Nordenfeldt, Maxim, Martini-Henry, Trenton, and Carbine, who won thirty-three races out of the forty-three for which he started, and was only once unplaced. Among the many good horses he met, were Abercorn (now in Ireland), Melos and Ensign. Carbine won the Melbourne Cup, 2 miles, by 2 lengths; beating 38 other horses and carrying 10 st. 5 lbs. in the then record time of 3 min. 28¼ sec. This time was beaten by Wakeful, by Trenton, when she won the Sydney Cup in 3 min. 28 sec., but with a lighter weight (9 st. 7 lbs.). Carbine was purchased by the Duke of Portland for 13,000 guineas, and many of his stock have shown good form in England. Besides Carbine, several of the best stallions in Australia, such as Trenton, and Carbine's three-quarter brother, Carnage, by Nordenfeldt (a son of Musket) out of Mersey, have been secured for England. Carnage was bought in England for Germany by Count Lehndorf for 10,000 guineas.

"Within the last few years, several horses of Galopin and St. Simon blood have been imported into Australia, and have been successful at the stud. The best of them was Bill of Portland, who was by St. Simon, and who got many winners. He did so well that he was repurchased for England, where he now stands at the Cobham Stud. Grafton, by Galopin, has been a stud success 'down under,' where Lochiel, by Prince Charlie out of Nellie Moore by Voltigeur, was another prominent sire of late years. He was got in England, but was foaled in the Colonies, where he proved his ability to go fast and stay. He was the sire of a great number of useful winners, though perhaps none of them were of the highest class, with the exception of Great Scot, who is inbred to the Blair Athol line, and who, after running well as a three-year-old, was purchased by Mr. R. McKenna for Mr. A. A. Apcar in India.

"In the pedigrees of many good Australian horses, the names of Arabs appear a very short way back, which is not

Photo by] [THE GRESHAM STUDIO, ADELAIDE, S. AUSTRALIA.

Fig. 491.—Mr. Barr Smith's thorough-bred Australian stallion, Neckersgat, which has sired many winners.

the case in other parts of the world. Respecting this subject, the Editor of *The Australian Stud Book* tells us that some of these supposed Arabs were English thorough-breds, which, after having raced in India, were sent to Australia as Arabs, on account of the popularity of Arabs in Australia at that time. Glaucus was one of these horses. Also, in the early days, pedigrees were very carelessly kept, or not kept at all, and consequently it is impossible to trace the source of some of the best Australian strains, as in the case of the well-known Sapho family, from which has sprung many good race-horses, including Merriwee, the winner of the Melbourne Cup. Newhaven, who won in England as Newhaven II., is another great horse whose breeding cannot be traced, because a pedigree was unfortunately lost. As a young three-year-old, he won the Melbourne Cup with 7 st. 13 lbs. up, making all the running and covering the 2 miles in 3 min. 28½ sec. He ran well in England, but as the English *Stud Book* is unfortunately closed to him, he stands at a trifling fee. He and others in a similar position are no doubt pure-bred, for 'by their works ye shall know them.'

"There is a good deal of steeplechasing in Australia, where the fences are of a very unyielding character, and frequently pass sentence of death on horses which fail to rise sufficiently high at them. These fences, which are mostly posts and rails and a few walls, induce a somewhat 'sticky' style of jumping, as compared with that in England. This difference in jumping is proved by the fact that several excellent Australian cross-country horses failed to reproduce their Antipodean form when sent to England; a notable example being Daimio, a Grand National winner in Victoria, who 'beat himself jumping,' when running in England. On the other hand, Ebor, who was only a hurdle racer in Australia, though good up to two miles, was a successful steeplechaser in the Old Country.

"Horses in the Colonies, taking them all round, have more thorough-bred blood in them than English horses. Unfortunately, Australia suffers from serious periodical droughts, during which, horses and other stock fare badly. A young horse that has been stunted during its first two years, never attains the good development it would have acquired under more favourable conditions. A great deal has been written lately about the deterioration of Australian horses, which is more or less true. One of the chief causes of this deterioration is the fact that of late years, horse-breeding has become a very unprofitable industry, owing to low prices. During the South African war, a demand for remounts sprung up, and many weedy horses which were exported, gave our Australian animals a bad name. Breeding from weedy horses, because they have run fast with 7 st. up, and are cheap, is a mistake that has done much harm in Australia, as elsewhere. As it is impossible to get even a moderate price in Australia

Photo by] [THE GRESHAM STUDIO, ADELAIDE, S. AUSTRALIA.

Fig. 492.—Mr. B. Allen's The Idler, winner of the Adelaide Cup, 1902.

for weedy mares, breeders have been unwise enough in many cases to breed from them, with, of course, disastrous results. In breeding saddle-horses it is essential that both parents should be good to ride on a long journey. Many of our best mares have been exported, chiefly as Indian remounts.

"Owing to the want of uniformity in the mares, buyers for export in the Colonies have great difficulty in getting a sufficient number of horses of the required stamp on one station. Often, a stallion runs with forty or fifty mares, out of which it would be hard to pick a fairly well-matched four-in-hand team, even putting colour on one side. In such a case, it is impossible for a stallion, no matter how suitable he may be in himself, to get uniform stock from such widely-differing mates. The only way to attain a fair amount of uniformity in any class of stock, is to have the parents, and if possible, the grand-parents, of the desired type. A mare that breeds a couple of bad foals should be 'culled' at once. Much good might be done to horses in Australia by instituting, as in France, steeplechases for stallions and mares only; by doing away with two-year-old races, at all events, in the spring; and by limiting the short distance races to geldings.

"Many parts of New South Wales and Queensland should be able to compete with all other countries in breeding saddle-horses; although in hot climates there is a tendency in horses to grow light, which should be guarded against by using sires and dams of good bone and substance. Horses bred in the interior where the land is high are superior to those which are produced on a lower altitude. In the desert country of Central Queensland, horses do splendidly on the spinifex; but a great part of the Northern Territory, and the hot damp districts on the northern coasts, are not suitable for horse-breeding.

"Excellent Clydesdale horses are bred in Victoria and New Zealand; but, at least in the former place, it is considered advisable to keep up the type by frequent importations from England."

Mr. A. B. Paterson (*The Sydney Mail*, 22nd March, 1902) says that "on visiting England one is at once struck by the difference between the English and Australian horses. The English riding horse, hunter, or charger is a massive animal with the strength of a dray-horse; his loins are as broad as a table; his hind quarters are filled out and fleshy; his ribs are round, with immense depth through the body; his hips are rounded over with muscle, and are a yard apart; his shoulders are deep and sloping, with a long rein and a head showing plenty of breeding. These horses, to Australian eyes, are too massive altogether, but when one gets on them they soon show that they have plenty of activity and pace, and they are so well broken that it is a treat to ride them." Australian horse-breeders, who have lately returned to this country,

Photo by] [THE GRESHAM STUDIO, ADELAIDE, S. AUSTRALIA.
Fig. 493.—Mr. J. Haldridge's thorough-bred Australian stallion, Carlyon; a famous sire and winner.

have told me that horses of the Irish weight-carrying hunter class are rare in Australia.

"The mistake in breeding horses here has been, in the first place, an inclination to get them too light, and then a desire to rectify that error by using roadsters, Clevelands, and such mongrels. Stallions of this class will throw back perhaps to the heavy side of their pedigree, perhaps to the light, but most of the progeny must necessarily be a failure in either case. People are inclined to be led away by the belief that they are following in the footsteps of the breeders of hacks and weight-carriers in the old country, but they are doing no such thing. . . . . There was a type of horses extant which men called Australian stock horses. Nothing now remains but a decayed remnant of this grand old breed. They were a distinct type, and when one mentioned the name Australian stock horse it was at once known what was meant, by all who lived in the country, at any rate. He was a big-bodied powerful horse on active legs, and the squatter took a pride and a pleasure in his production. For, as the Victorian remount officer now very truly says, this class of horse could be picked up in thirties and forties on numerous stations in the old days. On many runs, 75 per cent. of the horses would have been suitably adapted for the purposes required; but to-day three or four head is the limit of the powers of production in this direction of some of the very same runs."—(*The Australian Pastoralists' Review*, 16th July, 1900.)

"Crespin," writing in the same paper (15th Feb. 1900), confirms some of the foregoing remarks by saying: "What is probably the principal cause of so great a deterioration in the bulk of Australian horses is the fact of their being bred too weedy, and then an attempt being made to rectify the mistake by using mongrels of stallions called Clevelands and roadsters." Before condemning "Crespin's" use of the word "mongrel," we must bear in mind that the Cleveland and the Hackney are products of numerous crosses.

From the foregoing remarks we may conclude that the chief defects of Australian horses of the present day are want of substance, absence of a distinct type of saddle horse, and want of ability to endure hardship, as we have seen on pages 431 and 432. The product of the lightweight sprinter cross is more or less of the greyhound type, as we can see in Figs. 326 and 494. The type of Colonial horse required in India, and no doubt in Australia, is that of Romance (Fig. 487), whose points are much more like those of the foxhound than those of the long-tailed dog. As Australia is an admirable country for the breeding of stout thorough-breds, the desirable type of saddle horse could best be obtained by careful selection from that breed. Such a meritorious endeavour would be greatly facilitated

Photo by] [M. H. H.

Fig. 494.—Badly ribbed-up Australian gelding.

by the abolition of two-year-old races, by raising the weights, and by increasing the distances to be run.

By comparing the following table (which gives the respective ages of the racehorses that ran in Australia during the season of 1902) with that on page 426, we can see that the evil of artificial early maturity (p. 428) is not nearly so rampant in that country as it is in England:—

Two-year-olds	446
Three-year-olds	639
Four-year-olds	815
Five-year-olds	821
Six-year-olds	701
Seven and upwards	1,960
Total	5,382

In Australia many horses, especially old ones, compete in races without their ages being given. These animals are not included in this table.

"Luckily, in Australia nearly all our great races are long races. Consequently, all our great horses must be long-distance horses, horses of strength and endurance. The turf clubs have it in their hands to improve or deteriorate the breeds of horses, and they should hold it their bounden duty to do what they can in a right cause, for it is the only productive work which they can show for the thousands that pass through their books. It is indirectly on account of our long races that English breeders have come to Australia for horses of bone and substance. The horse that can win a cup or champion stakes with anything like a weight on his back is necessarily the horse to go 100 miles a day if he is needed. The Victoria Racing Club did a national good when they put a stop to hurdle-races of a mile and half" (*Crespin*).

Canadian Horses.—It appears that the only two distinct Canadian breeds are French Canadian cobs and Walpole Island ponies. Dr. Rutherford, Chief Veterinary Inspector of Canada, who has most kindly supplied me with illustrations of these animals, tells me that French Canadian cobs (Figs. 495 and 496) stand from about 14 hands to 15.1, and that they are descendants of horses imported from France, the blood of which was more or less mixed with that of horses brought from England for army use in early days. During the last twenty or thirty years they have been somewhat indiscriminately crossed with other breeds, and consequently the original type has been lost to a considerable extent. A stud-book has lately been started with the object of retaining as far as possible the best characteristics of the old French Canadian horse.

The brown cob in Fig. 496 is a typical French Canadian, especially in his coarse head, big ears, straight

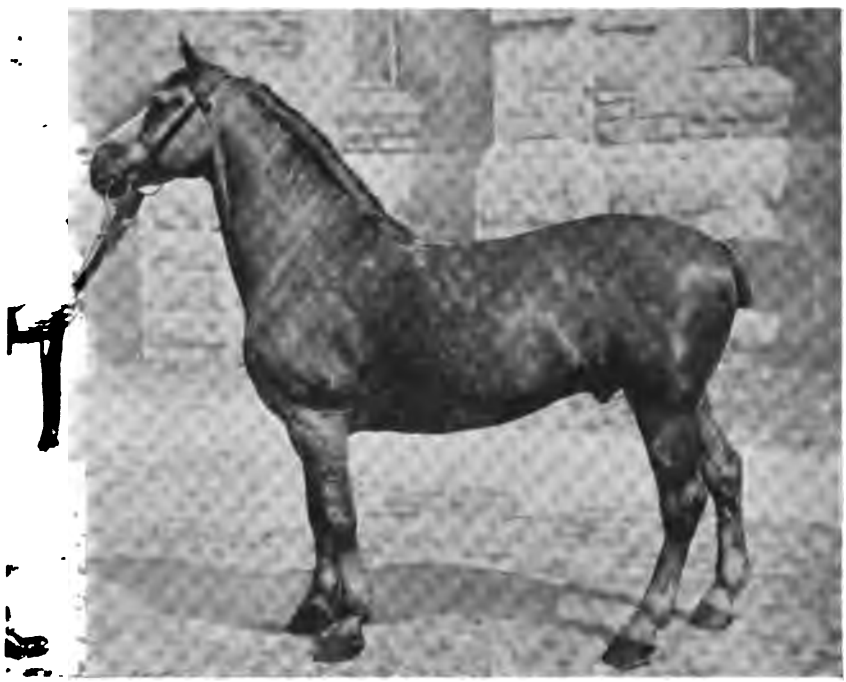

Fig. 495.—Grey French Canadian cob (15 hands).

shoulders, good depth of body, and somewhat short and sloping shoulders. Lowness of the withers as compared to the height of the croup is a peculiarity of the breed, which is more strongly marked in the grey (Fig. 495) than in the brown (Fig. 496), although the latter is a better type of the French Canadian than the former. These cobs are noted for strength and endurance, and, to judge by reports on them during the late Boer war, they are more suitable for harness than for saddle.

Dr. Rutherford writes that "the Indian pony from Walpole Island (Fig. 497) is not in any sense of the word a Cayuse. Walpole Island is in Lake St. Clair in South Western Ontario, fifteen hundred miles from the home of the Cayuse. The Walpole Island ponies are of French Canadian origin, but through the mismanagement which the Indian habitually inflicts on his horse, they have

Fig. 496.—Brown French Canadian cob.

decreased in size to about thirteen or fourteen hands, and have become slighter in conformation than their French Canadian progenitors. Some of them are neat and active, and when presentable, they sell fairly well as children's pets. The Cayuse or Western Indian pony is understood to be the direct descendant of the horses introduced by Cortez and his countrymen to Mexico, and the southern part of what is now the United States. Some of these animals escaped or were stolen, many became wild, and others were captured and used by the Indians. Their conditions of life and climate have made them hardy, diminutive and active, though by no means handsome. Some people profess to admire them greatly; but, personally, I think they are the most wretched specimens of horse-flesh I have ever seen. The use of the mares, on account of their cheapness, has been a very serious drawback to the successful raising of good and useful horses on the ranges of both Canada and the United States.

Fig. 497.—Indian pony from Reserve on Walpole Island, on Lake St. Clair, Ontario.

"The Police horse which was ridden by the Prince of Wales in Western Canada (Fig. 498), is said to be by a thorough-bred horse out of a range mare by a French Canadian sire out of a Cayuse mare."

South African Horses.—During a horse-breaking tour which I made through South Africa in 1891-92, I had excellent opportunities of studying the horses of Cape Colony, Orange River Colony, the Transvaal, and

Natal; for I broke in many scores of them, and was asked to judge horses at several agricultural shows which were held, while I was staying in that country. During 1901, I had the pleasure of renewing my acquaintance with these animals on two occasions when I went out to the Cape in veterinary charge of remounts, and of taking the photographs which illustrate these pages.

My first introduction to Cape horses was in the early sixties, when I was a subaltern in an Indian field battery. Throughout the fifties, the Cape Stud Department, which was under the control of that good horseman, Colonel Apperly, furnished a large number of very useful remounts to the Indian Army; but soon after the Mutiny, the supply dwindled down almost to vanishing point. To judge by the remainder which I saw and by a couple I owned, they were remarkably hardy and wiry animals, and were up to a fair amount of weight; although somewhat undersized (about 15.1) and rather plain about the head and croup. They were certainly well adapted for campaigning in India, on account of their having been bred in a dry and warm climate. This type of Cape horse is now practically extinct. The thick-set Transvaal gelding shown in Fig. 499 is, however, a near approach to it. As Australia is a much better horse-breeding country than South Africa, the continually increasing importation of remounts from the former country, appears to have closed the Indian market to those from the latter, and consequently Cape farmers did not find horse-breeding sufficiently lucrative for the employment of their time and money. We should here bear in mind that in South Africa there are few districts suitable for the breeding of valuable horses, and that the horse-breeders of that part of the world are, during the spring, summer and autumn, beset by the danger of "horse sickness." This disease and want of water are the two great banes of horse-breeding there; and the inordinate dryness of the country greatly reduces the supply of fodder and the amount of arable land.

Also, the indigenous locusts have an unpleasant custom of eating up every green thing during their frequent visits.

Nearly all the grass in South Africa is natural; "temporary" and "permanent" pastures being comparatively unknown. Consequently, on the grazing grounds there is a very large admixture of weeds and deleterious herbs.

Fig. 498.—Canadian horse which was ridden by H.R.H. the Prince of Wales, when in Canada in 1901.

Therefore the Cape horse, which has existed for many generations under this condition of pasture, has acquired the useful ability of being able to distinguish good grass from noxious herbage. If he is turned out on the veldt with several new arrivals from foreign lands, there will be no difficulty in recognising the native equine product from the others, by the peculiar way he grazes; because, instead of eating the plants as they come, he plucks his favourite grasses in small tufts, here and there, at comparatively wide intervals of space. This faculty of selecting proper food on the veldt is undoubtedly the chief cause which made him the best campaigner during the late Boer war.

The Dutch East India Company appears to have founded the race of Cape horses towards the end of the seventeenth century by the importation of Barbs and Gulf Arabs. Mr. Duncan Hutcheon, who is the Colonial Veterinary Surgeon, tells us in his interesting pamphlet, *Military Horses and How to Breed Them*, that "in 1792 eight stud-horses were imported from England. They are believed to have been of the early English roadster breed. In the same year, five stud-horses arrived from Boston, and the following year a number of horses and mares were brought from the New England States, and are described as of Spanish or Eastern blood. In addition to these, in March, 1807, during the Peninsular War, two French vessels were captured at the Cape, containing some Spanish horses *en route* to Buenos Ayres for breeding purposes. It is said that from these were obtained the blue and red roans which were considered by the colonists as so valuable for their great power of endurance. . . . It was in 1813, however, that the dawn of a new era in horse-breeding commenced at the Cape. In that year Lord Charles Somerset was appointed Governor of the colony, and soon after his arrival he directed his attention to the improvement of the Cape horse by means of the English thorough-bred, and during his term of office he imported a considerable number of first-class thorough-breds, both stallions and mares. During the three following decades, first-class thorough-breds continued to be imported by the leading horse-breeders of the Western Province, and the male progeny of these were distributed all over the colony as stud horses. It was after these importations had impressed their character and qualities on the native-bred stock—from 1840 to 1860—that the Cape horse reached the highest stage of perfection which it has ever attained. It was during the latter part of this period that large consignments of horses were shipped to India, which earned for the Cape horse such a high reputation with the Indian authorities."

The decay of horse-breeding at the Cape, which began about forty years ago, was considerably hastened by the

Photo by] [M. H. H.

Fig. 499.—Thick-set Transvaal gelding (15.1).

importation of weedy and worthless English thorough-breds, few of which I venture to think cost more than £50. At the same time, some of the Cape breeders, like Mr. Hilton Barber and Mr. Alec Robertson of Storm-fontein, employed good thorough-bred sires, and bred animals that were able to hold their own on the Turf against imported English race-horses. Like other dry countries (Arabia and India for instance), South Africa possesses the great advantage, from a horse-breeding point of view, that its equine produce hardly ever suffer from that form of laryngeal paralysis which is commonly termed "roaring," even when their dams and sires are "musical." Hence the fact of a sire being wrong in his wind is of little detriment to his stud career in that country. The noisy Belladrum and the still more obstreperous Candlemas, who was own brother to St. Blaise, are cases in point.

Photo by] [M. H. H.

Fig. 500.—Cape pony (13.3), showing Arab blood.

Mr. Mellish, whom I have the pleasure of knowing, has imported several high-class Cleveland bays and Hackneys for crossing with South African mares, and may probably be successful in producing fashionable trappers by their means; but such an admixture of blood would be useless for saddle purposes, if we may judge by the result of similar experiments which have been tried in India.

At present, the vast majority of South African horses might be fairly classed as ponies, from an English polo-pony point of view. Their blood is so mixed that it is impossible to divide them into distinctive classes, according to the districts in which they are bred. Of course I here refer to the ordinary South African horse or pony, whichever name we may like to give him; and not to thoroughbreds specially intended for racing, or the produce of recent foreign crosses. The South African as a rule is hardy, docile, sound, capable of standing a great deal

Photo by] [M. H. H.

Fig. 501.—Well-bred Cape pony (13.2).

of hard work, but is somewhat lacking in speed. Although his want of size and substance put him altogether out of the hunter class or the misfit hunter class, from which the English cavalry trooper is obtained, he makes a very useful hack, and an admirable mounted-infantry remount. His deficiency of blood and the semi-starvation diet which he has had to endure for several generations, unfit him as a rule for high-class polo.

The best horse-breeding districts I have seen in South

Africa are those of Colesberg in the Eastern Province, and of the Mooi River in Natal.

The most characteristic South African type of pony is a grey which shows a strong dash of Arab blood (Fig. 500). We can see specimens of this animal all over South Africa. It is strange that the Arab cross comes out more strongly in greys than in horses of any other colour ; for, contrary to the popular idea, grey is not the prevailing

Photo by] [M. H. H.

Fig. 502.—Ordinary type of Basuto pony (14.1).

colour among Arabs, as we may see by referring to the *Year Book of Indian Racing*, which contains descriptions of a large number of Arab ponies and Arab horses that have run in races for their respective classes. Bay is in fact the most common colour among Arabs. Fig. 501 is a good specimen of a Cape pony which has a fair amount of English thorough-bred blood. Almost all Cape ponies have tick-marks more or less widely distributed over their bodies, by which peculiarity they can generally be recognised.

The Basuto pony (Figs. 502 and 503) is a useful though ill-defined animal, whose name has become well known in England by his honourable connection with the late Boer war. An entirely unsupported story is current that his origin is due to a cross between Shetland pony stallions and Orange Colony mares. Mr. L. Barrett, Assistant-Commissioner, Basutoland, who has lived in that country since 1882, and who is consequently a reliable authority

Photo by] [M. H. H.

Fig. 503.—Well-bred Basuto pony (13.2).

on this subject, entirely discredits that story. He writes in *The Field* (19th October, 1901) as follows about "The Basuto Pony":

"When the territory recently known as the Orange Free State began to be occupied by Dutch farmers about the year 1845, the Basuto were largely employed by them as farm servants, and were paid for their services with stock-mares, cattle and sheep. This practice has continued, except when interrupted by wars, up to the present time. Besides this, droves of mares have been brought into Basutoland year by year, both from the Orange Free State and Cape Colony, by speculators, who exchanged them for oxen. The Basuto are a sporting race, and many well-bred stallions have found their way into the country; bought originally by the chiefs for racing purposes, and afterwards relegated to the stud. Representatives of Tormentor (by Wild Dayrell), of Sir Amyas Leigh (by Adventurer), of Libertine (by The Rake), of Berkeley (by Teddington), of Belladrum (by Stockwell—Catherine Hayes), and many others too numerous to mention, are to be traced in the hands of natives, crossed on the old Dutch breed obtained from the farmers, as above described. The comparatively small size and sturdy frame of the Basuto pony is to be ascribed to the influence of climate. The breeding stock live in the mountains winter and summer, exposed to the wildest weather and extremes of heat and cold, the thermometer in winter often indicating from 10° to 15° of frost in the rocky valleys and arid plateaux of the Maluti and Drakensberg Mountains, where the ponies are mostly bred. The spring and early summer are spent in recovering the condition lost during winter, and in April the frosts commence again, so that only a few months' growth can be made yearly, and the result when mature is the hardy thick-set Basuto pony. Its evolution is a simple enough matter when the conditions are known, and I fail to see the object of ascribing the virtues of the breed to mythical Shetland stallions, of which no local tradition exists; whereas what is perfectly well known is that the earlier Dutch and colonial strain has been of late years repeatedly crossed with and improved by the English thorough-bred and by Arabs imported by Government."

CHAPTER XXX.

CONTINENTAL HORSES.

French Horses—Spanish and Portuguese Horses—German Horses—Dutch and Belgian Horses—Danish Horses—Austrian Horses—Hungarian Horses—Polish Horses—Italian Horses—Russian Horses—Swedish and Norwegian Horses.

French Horses.*—We learn from Cagny and Gobert that "France contains about 3,000,000 horses, which number has been more or less stationary for the past ten years, and which is equivalent to about 9 horses for every 100 inhabitants. The value of all the horses, asses and mules in France amounts to about £40,000,000; and the value of the exported horses is much greater than that of the imported ones. We export horses to Germany, Belgium, Italy, Spain, the United States, and South America. We import pleasure-horses [*chevaux de luxe*] from England, Austria, Hungary, and the United States; and draught horses from Belgium and Holland. In France, the breeding of draught and coach horses is flourishing, the breeding of saddle horses is making great strides, especially in the South, Nivernais, and Charente; the breeding of coach horses pays better in Normandy than that of saddle horses; and the breeding of thorough-breds is particularly prosperous, and successfully rivals that industry in England." These good results afford abundant proof

* The following remarks on French horses have been compiled chiefly from Sanson's *Traité de Zootechnie*, Gayot's *Les Chevaux de Trait Français*, Gallier's *Le Cheval Anglo-Normand*, Cagny and Gobert's *Dictionnaire Vétérinaire*, and Charles du Hays' *Le Merlerault, ses éleveurs, ses chevaux, et le haras du Pin.*

that the soil and climate of France is well suited to horse-breeding.

The chief French breeds are: the Boulonnais, Percheron, Breton, Ardenne, Norman, and Tarbes, all of which contain a large admixture of foreign blood.

Boulonnais Horses (Figs. 504 and 505) are the most characteristic French breed, and are a fine type of the

Photo by] [J. DELTON, PARIS.

Fig. 504.—M. A. de Wazieres' Boulonnais stallion, Réjoui (16.1).

heavy draught horse. They are bred not only in the country near Boulogne, from which they derive their name, but also in the neighbouring provinces, and especially where hard work requires horses of great power. Hence the cart-horses of Picardie, Haute Normandie, Artois and the French part of Flanders are merely varieties of the Boulonnais. "Towards the end of the eighteenth century, attempts were made to lighten this breed, by crossing it with Barbs and Arabs, which were plentiful in the Government studs. In this way, the black or bay colour of the Boulonnais became changed into roan or grey, which tints have been transmitted to and fixed in all French cart horses, owing to a prejudice it is difficult to explain" (*Gayot*). Sanson says that there is "no uniformity of colour, which may be either light or dark. In the Boulonnais we find all colours and all

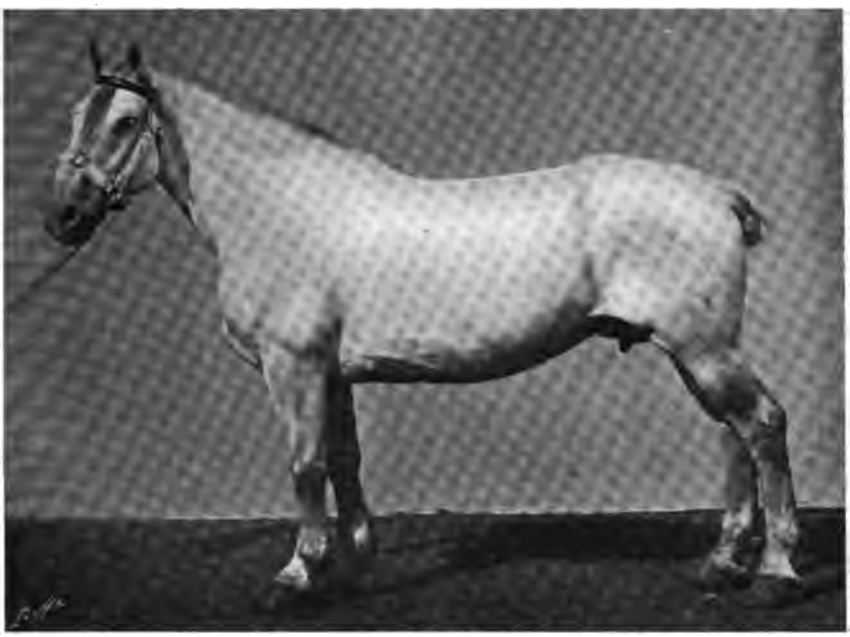

Photo by] [J. DELTON, PARIS.

Fig. 505.—Boulonnais brood mare, Margot.

shades, such as bay, red roan, blue roan, and dappled grey, none of which predominate." Formerly, this breed was entirely agricultural, but to meet modern requirements of heavy draught, it has gradually been made heavier and stronger, by artificial selection and good feeding, and is now represented by animals of immense weight and power. "These horses form the large majority of those employed for heavy draught purposes in Paris, which is the best place to judge their value. They are the finest horses of their class in the world" (*Sanson*) The bone and muscle of those I saw in Paris left a similar impression on my mind.

"The Boulonnais horse is very good tempered. His frame becomes developed so quickly, that he can be used for farm work, when he is eighteen months old, and he attains his full height and weight when he is four or five years old. As a rule, he is much more active than he looks" (*Gayot*). His height varies from 16 to 17 hands.

Ardenne Horses (Fig. 312) are either French or Belgian horses, according to the part of the Ardenne country in which they are produced. The French Ardenne horses are bred chiefly in the department of Haute-Marne and in the valley of the Meuse. A hundred years ago, they varied in height from 14.1 to 15.1, and were strongly built, docile, high-spirited, very hardy and great stayers. They were chosen by Marshal Turenne (1611-1675) as remounts for his cavalry, and acquitted themselves with great distinction during the terribly trying campaign of 1812, against Russia. Since those days, efforts made to increase their size by crossing them, especially with Belgian cart horses, have made them bigger and heavier, but have proportionately diminished their vigour and power of endurance. The *Mountain Ardenne* is a smaller and hardier variety.

Percheron Horses derive their name from the ancient province of Perche, which is the country that is now bounded by the departments of Orne, Eure-et-Loir, Loir-et-Cher, and Sarthe. The stock of this breed are raised chiefly in the country round Montagne, Bellesmes, Nogent-le-Rotron, Saint-Calais, Courtalain, and Mondoubleau. The soil of that country is principally clay which rests on a limestone sub-soil.

The typical old-style Percheron (*Percheron postier*) was a grey harness horse which was from 15.2 to 16 hands high, and was famous for his very useful ability to trot fast and long, with a heavy load behind him. He matured quickly, and was able to do a fair share of work at the age of two years. Formerly, he was the great horse in French diligences and mail carts, and was employed to a large extent in London omnibuses. This strong and hardy breed has almost entirely died out, owing to the increasing demand for heavy horses, and has been largely replaced by the big Percheron (*Gros percheron*), which is usually from 16 hands to 16.2 high, and is essentially a heavy draught

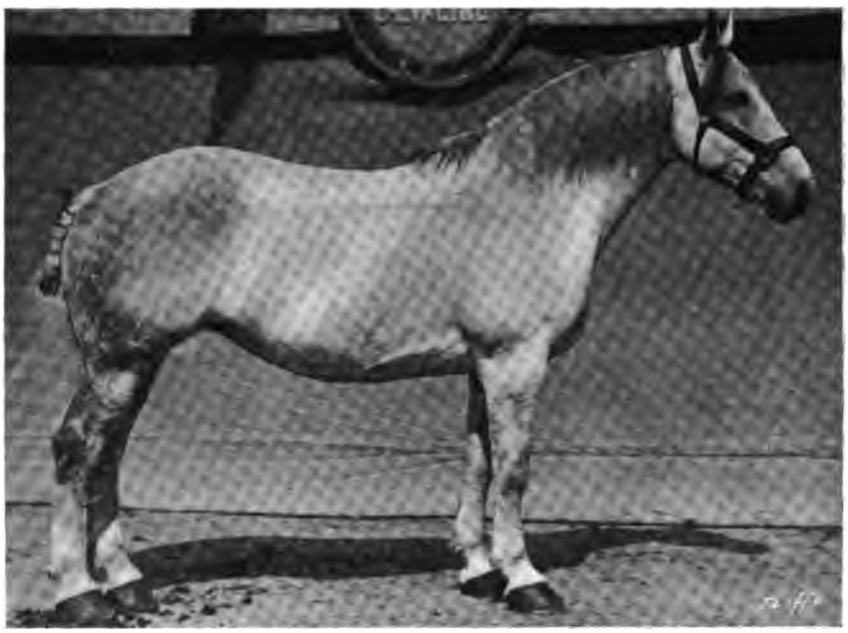

Photo by] [J. DELTON, PARIS.

Fig. 506.—Percheron mare, Martha (16.2); winner of many prizes.

horse (Fig. 506). Although he is not quite as weighty as the Boulonnais, with whom he has been largely crossed; he is much more active. This cross-bred Percheron is popular in America, where the American Percheron Stud Book was formed in 1876.

Breton Horses.—The conditions of climate, soil and water have made in Bretagne, as elsewhere, a fairly sharp line of distinction between its breeds of horses. Thus, on the fertile pastures near the sea-side of that country, we find the heavy cart-horse; on the plains of the interior, a lighter animal; and on the mountains, a pony.

Breton cart-horses (Fig. 507) are divided, in a somewhat arbitrary way, into two varieties, namely, those of Léon, and those of Conquet. The former are bred in the departments of Côtes-du-Nord and Finistère, particularly in the district of Saint-Pol-de-Léon. These horses are strong

Photo by] [J. DELTON, PARIS.

Fig. 507.—Breton cart stallion, Cadoudal (16 hands); winner of the 1st prize at the Concours Hippique.

and coarse-looking, and generally have a good deal of hair about their legs. They stand from 15.2 to 16.2, and are usually grey. Occasionally, bays and roans are seen, but blacks are very seldom met with. The cart horses which are bred in the country to the south-east of Brest (*Chevaux de Conquet*) are generally bay, though sometimes grey; and they rarely exceed 15.2 in height. The Breton cart-horses, though not very well shaped, are good and quiet workers. Periodic ophthalmia is common among these animals, especially among greys.

The horses in the country between Lannion and Dinan vary in height from 14.3 to 15.3, and are of the light draught type. Many of them are good trotters, and make excellent "nag" horses for farmers.

The horses bred in the mountains of Bretagne are thick-set, and rarely exceed 14.3 in height.

Photo by] [J. DELTON, PARIS.

Fig. 508.—Bay Anglo-Norman mare, Nevada (16.2).

Breton horses have been crossed a good deal with the Percheron, Norfolk trotter, and thorough-bred. Gayot says that the stock (*Percheron-breton*) produced by the union of Percheron stallions with mares which have been bred on the coast of Côtes-du-Nord, make as useful cart horses as can be found in any other part of the world.

Horses of Normandy.—Owing to long continued crossing with all kinds of breeds, there are no true Norman horses chestnut. They are essentially omnibus and mail cart horses. They trot in good, easy style, and sometimes with high action, even when drawing a heavy load. With the idea of improving them, they were formerly crossed with Anglo-Normans, the result being that they became more elegantly "topped," but with loss of bone below the knees and hocks, and they consequently became

Photo by] [J. DELTON, PARIS.

Fig. 510.—A Tarbes mare.

less useful. Of late years, they have been crossed with the Boulonnais, so as to give them more substance, in order to meet the demands of the American market.

Common bred cart-horses are produced near Argentan and Domfont. They stand from 14.2 to 16 hands, and are heavy, coarse looking animals. They are good tempered and are useful for agricultural work. Formerly, they were used for field artillery, but are not now employed in the army.

2. *Army horses.* Anglo-Normans are largely used in the French army, especially as remounts for the cavalry of the line. Horses of this dragoon type are very popular among the breeders of the Caen country; because, if they are not selected by the remount department, they can be easily sold as horses of general utility.

3. *Coach horses,* in which there is very little uniformity of type.

Photo by] [J. DELTON, PARIS.

Fig. 511.—Bay Anglo-Arab mare, Belle de Jour (16 hands).

4. *Trotters.* These Anglo-Normans are chiefly bred in Merlerault, and are probably the best of their class in Europe. Their excellence in this respect is mainly due to the fact that many of their progenitors possessed the trotting instinct (p. 34). They are hardy and enduring.

Horses of Tarbes (Fig. 510).—This designation is now applied to the horses which in olden days were known as horses of Navarre; although it would be more correct to term them horses of the Pyrenees. The title, horses of

Tarbes, originated from the fact that the best representatives of this equine variety, were bred (as they now are) in the plain which surrounds the city of that name. Fossil remains show us that horses inhabited the country of the Pyrenees during the Stone Age.

Ill-advised crossing has done much to spoil these hardy and serviceable horses, which have good bone and feet, nice paces, and are quiet, plucky and enduring. They vary in height from 14.2 to 15 hands, and make excellent light cavalry horses, trappers and hacks. They are largely used in the French cavalry. Their colour is generally dark, and only a few of them have grey coats. In their country, there are two Government depôts for stallions, one at Tarbes, the other at Pau, in both of which, the stallions are Arabs, or Anglo-Arabs that have more Arab than English blood.

The Anglo-Arab (Fig. 511) is a popular cross (Thoroughbred and Arab) in France.

Spanish and Portuguese Horses.—We read in de Simonoff and de Moerder's *Races Chevalines*, that when the Saracens conquered Spain in the eighth century, they brought from Africa many saddle horses of the Eastern type, which, later on, were crossed with the heavier native Spanish horses. This crossing produced the famous Spanish horses of the sixteenth and seventeenth centuries. These animals had Roman noses, arched necks, goose rumps, long manes and tails, extravagant action, and were ideal horses of the ancient high school, from which the "Spanish walk" and "Spanish trot" have emanated. Descendants of this most highly-fashionable breed are still preserved in the Austrian Imperial Stud at Kladrub (p. 526).

Spanish horses of the present day are in a very degenerate condition, although the Andalusian (Fig. 512) still maintains a small remnant of his former high reputation. In Spain, donkeys and mules are about four times more numerous than horses, which have gone out of fashion in that country. For harness, mules are almost exclusively used, and horses are occasionally ridden. In Portugal, mules and donkeys are more popular, and horses less popular, even than in Spain.

German Horses.*—Although Germany has several breeds of horses which are suitable for commercial and

Photo by] [J. DELTON, PARIS.

Fig. 512.—Andalusian stallion (16.1).

military purposes, she imports many English horses. Horse-breeding in that country is greatly influenced by military requirements, and there are few of the powerful and compactly built type, such as the English Shire horse, which can draw a heavy load by itself. It appears that all German cart horses are expected to work in pairs and to

* The following remarks on German horses have been compiled chiefly from Count Wrangel's *Das Buch vom Pferde*, Major Schoenbeck's *Reithandbuch*, and Doctors Ramm and Buer's *Nachrichten aus den hervorragendsten Pferdezuchtgebieten des In- und Auslandes.*

go at the trot. Nearly every vehicle, except a cab, has a pole, even when only one horse is used. As German horses are more or less of the saddle and carriage type, the Government would have no difficulty in obtaining a large number of serviceable remounts for all kinds of military work. During the last few years, the Government and various societies of horse-breeders have greatly

Photo by] [F. ALBERT SCHWARZ, BERLIN W.

Fig. 513.—Well-bred East Prussian mare, Cajenne.

encouraged the breeding of good horses. In many states, the Government exercises a strict supervision over this industry.

East Prussian horses (Figs 513 and 514) bear somewhat the same relation to other German horses as Irish horses bear to English horses. East Prussia has more horses to the square mile (omitting towns of over 10,000 inhabitants) than any other part of Germany. It supplies annually from 4,000 to 5,000 remounts to the Prussian army, and many to the respective armies of Saxony, Bavaria and Würtemberg. Count Wrangel tells us that it could mount all the German cavalry regiments. The greatest horse-breeding centre of East Prussia is the stud at Trakehnen, which was founded in 1732 by Frederick William I., King of Prussia and father of Frederick the Great. He fur-

Photo by] [F. ALBERT SCHWARZ, BERLIN W.

Fig. 514.—East Prussian remount gelding.

nished this stud with 1,101 horses from the Royal studs, and the land, which, until it was cleared in 1725, was all "swamp and shrub." The importation of some Arabs and many English thorough-breds has greatly improved the East Prussian breed. Count Wrangel (1895) says that the Trakehnen horse (Fig. 515) has a good temper, great endurance, a fine head, well-formed neck, strong back, and is well ribbed-up. As a rule, the depth and slope of his shoulders are not satisfactory; he is inclined to be rather long on the leg; he looks a little too light for his height; and he lacks the elegant action that is admired in carriage horses. Trakehnen horses had not much success at the London International Horse Show a few years ago.

Major Schoenbeck (1902) tells us that East Prussia, Hanover and Holstein are admirable breeding countries

Fig. 515.—Trakehnen horse, property of Major Schoenbeck.

for remounts, and that the East Prussian is a born soldier's horse, although he has, perhaps, too much English thorough-bred blood in him. He stands from 14.3 to 16.3, and is hardy, fast, clever and docile. He does not become fully developed until his sixth year, and, if he has been properly treated up to that time, he will remain serviceable till he is twenty years, or even older. His action is usually good, and any faults he may have in this respect, can generally be cured by careful training.

Count Wrangel remarks that the conformation of the East Prussian horse has changed a good deal during the last twenty-five years, and that the " Light East Prussians," of which even now much is heard, are gradually disappearing. Increased attention to their breeding and management has made them larger and stronger, and now-a-days they make serviceable riding and carriage horses which can also be used for commercial purposes.

Photo by] [F. ALBERT SCHWARZ, BERLIN W.

Fig. 516.—Hanover half-bred mare, Narde.

Hanovarian horses (Figs. 516 and 517).—Through the influence of the English Hanovarian Kings, many English thorough-breds were sent to Hanover between the years 1714 and 1837. Hanovarian horses are bred on the fertile pasture lands of the valleys of the Elbe, Weser, Ems and their tributaries. The chief horse-breeding centres are the districts of Stade and Celle. The Hanovarian stud book says that " the object of the breeders is to produce strong half-breds of high quality, the lighter specimens of which will make sturdy riding horses; and the heavy ones, fairly strong coach horses. If used as remounts, they would be dragoon horses or artillery wheelers." These horses are bred by farmers who work the brood mares on their land. Major Schoenbeck considers that the Hanovarian horse has

Photo by] [F. ALBERT SCHWARZ, BERLIN W.

Fig. 517.—Hanover half-bred stallion, Kingaro.

quite enough blood, and that it has more bone and substance than the East Prussian, but it is softer, and its hind action is not so good. Although they are well bred, they are big and heavy, and are used more for draught than for saddle. They have strong legs and a good back, on which they can carry a load sufficiently heavy to make them serviceable military horses.

Near Osnabrück, which is in Hanover, is the stud of *Drenthe horses*, which originally came from Drenthe in

Holland. Their colour is black, and they supply London with funeral horses.

Holstein horses (Figs. 518 and 519).—Holstein, with its splendid pasture lands, is well fitted to produce horses of power and substance. The alluvial pastures of Kremper, which is in the district of Steinberg, on the right bank of the Elbe, are particularly well known for their good

Photo by] [F. ALBERT SCHWARZ, BERLIN W.

Fig. 518.—Holstein coach stallion, Jülf.

horses. Five hundred years ago, large prices were paid for Holstein horses in France, and before the Reformation the monks had flourishing horse studs on the large estates of the Church in Holstein. The horses of Holstein have not always kept up their former high reputation; but of late, careful breeding has raised their standard of excellence, and at present, Holstein produces fine powerful horses which have good legs and free action. These animals are suitable for both riding and driving, and are in great demand; but it is doubtful if they are as serviceable and enduring as the East Prussian. Many young Holstein horses are brought over to England, and are taken back to Germany after a few years, and sold as English horses.

Mecklenburg horses (Fig. 520).—Mecklenburg possesses high-lying clover pastures which are admirably adapted

Photo by] [F. ALBERT SCHWARZ, BERLIN W.

Fig. 519.—Holstein carriage mare, Ordonnanz.

for the production of good horses. Although Mecklenburg horses were the finest saddle horses in Germany eighty or ninety years ago, their breeding arrangements have been so badly managed and English thorough-bred blood has been so indiscriminately introduced, that the best horses now in Mecklenburg are those of the Hanovarian or Holstein breed which have been brought there, in order to grow up under the favourable Mecklenburg conditions of soil and climate. Therefore, there are good horses in Mecklenburg, but they are not Mecklenburg horses.

Rhenish Prussian horses.—The Rhine provinces are the principal centre for breeding heavy horses in Germany. Although that country has no famous breed of the Shire, Clydesdale, or Boulonnais type; efforts are now being made to breed a powerful and well-built cart-horse (Fig.

Photo by] [F. ALBERT SCHWARZ, BERLIN W.

Fig. 520.—Mecklenburg half-bred mare, Flamme.

521), with strong bone and free action. In 1897, as many as 81.38 per cent. of the non-military horses, outside the large towns in the Rhine provinces, were cart-horses, but most of them were of foreign origin, and only 9 per cent. were home-bred.

Oldenburg horses (Fig. 522).—"Most lovers of horses will acknowledge that their value, from a useful point of view, is not particularly great. The majority of Oldenburg horses which I have seen, have given me a very bad impression, and I would not use them for breeding at any price. As I may have been unfortunate in my acquaintance with them, I will merely say that their hereditary defects are heavy heads, weak backs, bad ribs, long legs, 'tied-in' below the knee, flat and brittle hoofs, and want of endurance. These defects ought to prevent people

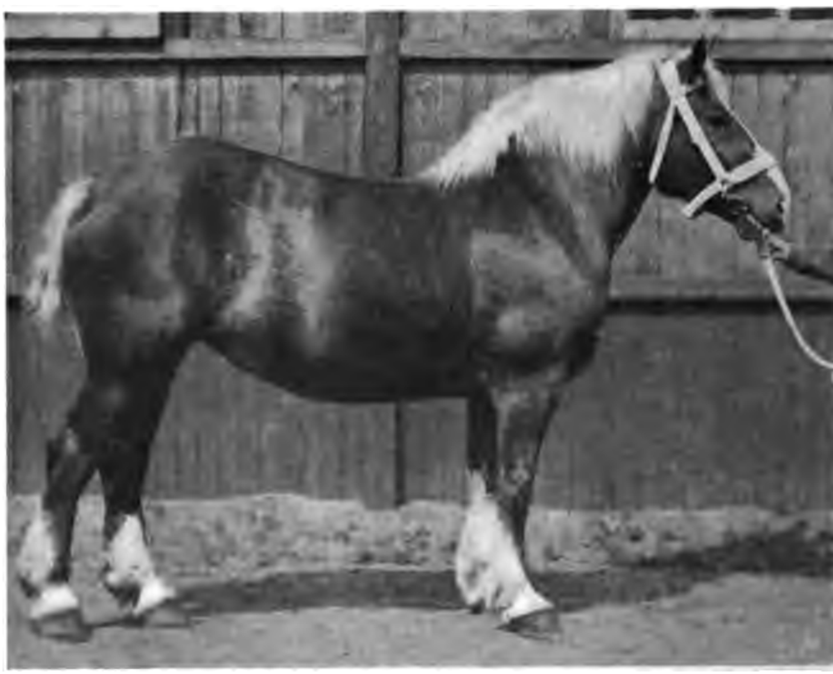

Photo by] [J. DELTON, PARIS.

Fig. 521.—Rhenish-Prussian cart mare (16.2).

from breeding such animals, because the fact that a horse is 17 hands high and broad in proportion, has good manners and matures at an early age, is not sufficient to make a breeder ignore other and far more important qualities" (*Count Wrangel*). This writer says that these horses seem to be unable to thrive, except on their own pastures, and consequently they are a failure, when taken to other districts.

East Friesland horses.—In East Friesland, during the middle ages, was bred a strong and heavy war horse, which became gradually changed into a stately coach horse. Although there are defects in the methods of breeding in East Friesland, the horses of that Hanoverian district (Fig. 523) have always occupied a good position in Germany, and many of them are exported to France and England. German authorities consider

Photo by] [F. ALBERT SCHWARZ, BERLIN W.

Fig. 522.—Oldenburg heavy cart stallion, Lomet.

that they do not grow up as well as they ought to do, because they get too much grass and hay, and not enough oats; and that consequently, they often lack in good bone, hardiness and endurance.* They are put to all kinds of work when they are only three years old. *The East Friesian Stud Book* says :—

* As these defects do not result from feeding on grass in many parts of Australia, New Zealand, South America, Kentucky and other countries, the nature of the soil is probably the agent upon which the blame should be placed.

"The object of breeders is to produce a strong, noble and docile carriage horse, which, when young, will develop so quickly with proper food, that it can pay for its keep at light agricultural work, and in its third year, will refund a part of its cost of rearing. When it is three or three and a half years old, it should be so well developed

Photo by] [F. ALBERT SCHWARZ, BERLIN W.

Fig. 523.—East Friesland cart stallion, Jellachich II.

that it would be taken by a dealer as an aged horse,* and sold at the full price of a good carriage horse."

Schleswig Horses.—The former Duchy of Schleswig may be divided into three parts which run parallel to each other. The eastern division contains a large proportion of very fertile clay soil, for the cultivation of which, powerful cart-horses are required. The middle portion, which has sandy soil, is not very productive, and the farm

* No doubt, supposing that the animal's mouth was not examined.

work on it is exceptionally light. The western division has luxuriant pastures, some parts of which have remained unploughed for more than a hundred years. The soil of this division is well watered by rain and fogs which come up from the sea. Under these conditions, Schleswig has always been able to produce powerful horses, which, in

Photo by] [J. DELTON, PARIS.

Fig. 524.—Chestnut champion Belgian cart stallion, Rêve d'Or (17 hands).

the middle ages, were able to carry knights in heavy armour, and to do all kinds of useful pack and draught work. Nowadays, they (Fig. 369) make excellent cart-horses and field artillery wheelers.

Many kings and dukes formed horse-breeding studs in Schleswig, and the one which remained longest in existence, was that which was founded by Friedrich III. (1648—1670). Even at the present day, horses whose origin can be traced back to that stud, can be found in the northern part of this horse-breeding country. In 1891, was formed the Registered Union of Schleswig Horse-breeding Societies (*Verband Schleswiger Pferdezuchtvereine, eingetragener Verein*), the object of which is to supply "a strong working-horse that can fulfil agricultural, commercial, and military requirements." This society is well supported by Schleswig farmers, who find

Photo by] [J. DELTON, PARIS.

Fig. 525.—Chestnut Belgian cart mare, Caline II. (16.1), by Rêve d'Or out of Julie.

that the growing of corn is not so remunerative as the breeding of heavy cart-horses.

As Schleswig is close to Denmark, and has at times belonged to that kingdom, there is a good deal of Danish blood (Fig. 452) in the cart-horses of that country.

Dutch and Belgian Horses.—"In the eighteenth century, Holland was famous for its trotters, the colour of which was generally black. They were the progenitors of the trotters of Russia and Norfolk. Nowadays, the Dutch pay no special attention to the breeding of trotters, and the trotters which are met with in that country, are more or less degenerate descendants of the old breed" (*de Simonoff and de Moerder*). These authors tell us that in Holland and Belgium, neither the State nor wealthy men maintain large studs for horse-breeding, which in these countries is entirely an agricultural industry. In the north of Holland, a good type of heavy carriage horse is

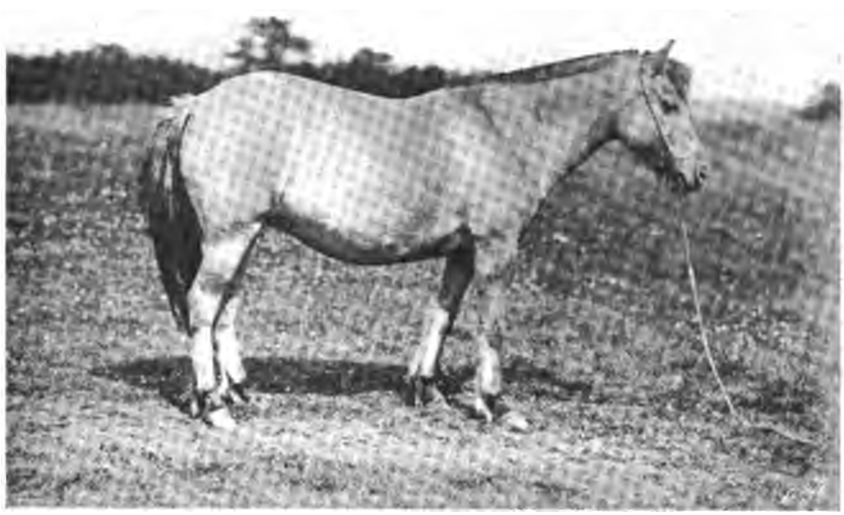

Photo by] [M. H. H.
Fig. 526.—Yellow dun Iceland mare with hogged mane (11.3).

produced; and in the south, a horse which closely resembles the Belgian heavy cart-horse (Figs. 524 and 525). In early days, many Dutch and Belgian (Flemish) horses were imported into England, and helped to form the Shire breed. In connection with the remarks made on page 401 *et seq.*, it is instructive to note that Holland and a large part of Flanders are very low-lying countries. A quarter of a century ago, many Belgian horses were used in England for omnibus and van work, but as most of them proved "soft" in constitution, they gradually fell into disfavour. The Ardenne horse (p. 500), belongs to Belgium, as well as to France.

Danish Horses.—We read in de Simonoff and de Moerder's *Races Chevalines*, that during the seventeenth and eighteenth centuries, Danish horses held a very high

Photo by] [C. REID, WISHAW.

Fig. 527.—Iceland pony.

reputation, and were exported to all the countries of Europe. The somewhat small though sturdy native horses of Denmark became larger by the introduction of Spanish, Neapolitan, Turkish, English and Dutch blood. The most important of all the Danish studs was that which was founded at Frederiksborg, near Copenhagen, in 1562. It flourished up to the beginning of the nineteenth century, when it began to decline, and was shut in 1862. Horse-breeding in Denmark followed more or less the same course, and received its severest blow by the Prussian annexation of Schleswig-Holstein, which deprived Denmark of its best pasture land. In Jutland, and especially in the southern part of that province, cart-horses are bred of a type somewhat similar to those of Schleswig (p. 520). The horses of Zealand and all the other islands of Denmark are thick-set ponies. In certain districts on the sea-coast

Fig. 528.—The Austrian Emperor's Kladrub stallion, Raverusto (18 hands).

are found small ponies which are generally of a grey colour, and resemble Iceland ponies. Like these animals, they live entirely in the open, and in a semi-wild state.

In *Iceland*, which is an island that belongs to Denmark, the horse family consists of strong, hardy and active ponies (Figs. 526 and 527), which are very like those of Sweden, Norway, Finland, North Russia, and the Hebrides. Some of them have no hind chestnuts (p. 319), and almost all of them amble from birth (p. 104).

[illegible]

[illegible] connection of the [illegible] with those of Spain and [illegible] Charles V and some of [illegible] were imported into Austria and [illegible] with the result of the formation [illegible] "Kladrub Horse," which is used only for [illegible] and by the Archbishop of Olmütz [illegible] takes its name from the Kladrub Imperial stud in Bohemia. The chief characteristics of this breed are their Roman noses, arched necks, heavy crests, great height, the most prized being from 17 to 18 hands high, "extravagant" action and perpendicular position of their necks when in harness. They evidently inherit these peculiarities from their Spanish ancestors, which had similar conformation and action; and as these characteristics are greatly admired, they have naturally been accentuated during many years of artificial selection. These horses are bred only in two colours, namely, black and white. This breed, which is sometimes called "The

* I have compiled the remarks on Austrian and Hungarian horses almost entirely from notes most kindly given to me by Mr. H. Reynolds, M.R.C.V.S., who has lived for many years in Austria. He has also supplied me with the photographs of these horses.

Large Spanish Horse," is regarded in Austria as the finest and handsomest type of carriage horse in the world. They are the pride of the Imperial stable, and are used by the Emperor only on very great occasions, and then in teams of six or eight; all of one colour, either black or white. "Show" being the essential point in their employment, their trotting speed is limited to two or three miles an hour, so that they may have abundant time in which

Fig. 529.—The Emperor of Austria's Lippizaner stallion, Sardagarta.

to exhibit their highly fashionable action. Raverusto (Fig. 528) is one of the most typical horses of this Imperial breed. He is a white stallion, 25 years old, and stands about 18 hands high. The entire, Sacramuso (Fig. 294), who is nine years old, is an excellent type of the black Kladrub.

Lippizaner Horses, of which Sardagarta (Fig. 529) is probably the best specimen, are good-looking, full of courage, showy, useful, and moderately fast carriage horses, and are excellent for high school work, although they are too much of the harness type to make good out-door riding horses. They are ridden by the Imperial Guard, but only for parade purposes. Their trotting action is high and true ; they keep their necks well arched during movement ; and their shoulders are well set-on. When young, they are inclined to be "soft," but the hardening process can be successfully accomplished, if it

Fig. 530.—The Emperor of Austria's black Haflinger pony, Martl (13.3).

is gradually applied. These horses are chiefly of Eastern origin, and are bred at the stud of Lippiza, which is near Trieste. Their proper colour is grey, which is now more or less varied, owing to crosses with English half-breds, which have, unfortunately, altered the former type a good deal. Lippizaner horses are greatly used in the Imperial stables and in some other parts of Austria, but not very extensively, owing to their being rather small ; generally, not over 15.1.

Pinzgauer Horses, of which the horse in Fig. 407 is a typical example, are the heavy draught breed of Austria, and, according to Sanson (*Traité de Zootechnie*), are of Friesland origin. They obtain their name from Pinzgau, a district in Styria; but their breeding has extended from Styria to Salzburg and Upper Austria. They stand about 16.2, and their typical colour is red roan with characteristic bay spots on the haunches. Pinzgauer

Fig. 531.—Bosnian pony (13 hands).

horses resemble Suffolk Punches (Fig. 453), by their shape and by the absence of "feather" (long hair below the knees and hocks). They are very powerful and are steady pullers. They are in great request all over the Austrian Empire, but are unfortunately degenerating, owing to crossing with other strains.

Haflinger Ponies.—Martl (Fig. 530), which was ridden in the mountains as a shooting pony by the Emperor of Austria, is a typical specimen of this Tyrolese breed. They stand about 13.3 high, and are used for draught and also as riding ponies in the mountains, at which work they excel, owing to their extreme sure-footedness. It is wonderful to see them climb, with either a living or dead load, up and down steep mountain sides and passes strewn with large boulders and small loose stones. They are very slow, but very safe. They are best ridden without reins, for they usually carry their heads close to the ground when climbing. This type is gradually dying out, on account of indiscriminate crossing. They would make admirable mounted infantry cobs for a hilly country, because they are as sure-footed with eighteen stone on their back, as with ten stone.

Bosnian Ponies.—Many ponies, from 12 to 13 hands high, are bred in Bosnia. They are strong, hardy and enduring. The animal shown in Fig. 531, is a typical pony of this breed, but is unusually fat.

Hungarian Horses.—In Hungary, the horse-breeding industry is limited chiefly to the production of remounts, which vary in type from an artillery wheeler (Fig. 532) to a light cavalry horse, of which we have a good example in Fig. 533, although the animal depicted in that illustration is a Horse Artillery leader. An officer's charger is shown in Fig. 534; and a Ulan (lancer) trooper in Fig. 535. These horses have sound legs, good hocks, plenty of bone, intelligent heads, and have few coarse features about them. They are particularly enduring, stand both hot and cold weather well, are not fastidious about their food, and are well up to weight. Their average height is about 15.2. The animal in Fig. 536 is a typical Hungarian farmer's horse. Both he and his rider are decked-out in their respective national costumes which are worn on *Banderia* (festive parades) and farmers' races.

The climate and soil of Hungary is admirably suited to the breeding of all kinds of horses, except, perhaps, those of the heavy draught type. As these favourable conditions have been backed up by the State, Hungarians are the best, hardiest, most enduring, and cheapest horses in the Empire, and are consequently more used in the Austrian army than any other breed.

As heavy draught horses are not required in Hungary, none have been imported. In that country, the carriages and wagons are of light construction. When they are heavily laden, two horses are put in; and if the roads

Fig. 532.—Hungarian Artillery wheeler (15.3).

are very deep, four or five horses are employed, and are often driven at a gallop,

The original Hungarian horse was a small and hardy animal, generally, of a bay colour, and without any white on the legs. Some were of other colours, such as grey, dun, and chestnut. This type has entirely changed, owing to the frequent importation of English thorough-breds, since the early part of the nineteenth century. The Government began breeding on a large scale for military purposes, and encouraged farmers to act in the same way. In almost all cases, the Government stallions were half-bred English, and the farmers had their mares covered at Government depôts, which are distributed all over the country. Hungary is so large and prolific, that horse-breeding cost hardly any money in former times, and is still a paying business, despite the increased expense of labour and living. The cost of breeding and bringing-up a three-

Fig. 533.—Hungarian Horse Artillery leader.

year-old in a Hungarian magnate's stud, amounts, at the back end of the year, to about 200 florins, which is about equal to £16 10s.; and at that time, such an animal, which will naturally be of high class, can be sold on an average at from £35 to £40. Ordinary farmers' horses will bring from £16 to £25; and common, low-grade animals, from £8 to £10. Many thousands of the last mentioned class of horse were purchased for our Army Remount Department, and sold, at from four to five times the amount they cost, to the British Government for service in South Africa during the late war. We are all aware that mounting our men on these inefficient animals was the cause of the death of thousands of our soldiers. This misfortune could have been obviated by making the selection from ordinary Hungarian farmers' horses, and, even then, the buyer could have made many tens of thousands of pounds by the transaction. There

Fig. 534.—Hungarian officer's charger.

were three English veterinary surgeons living in Hungary at that time, but none of them was consulted by our Army Remount Department with respect to the purchase of remounts, on which subject they had of course much expert knowledge. Fig. 537, which is the reproduction of a photograph I took in South Africa in 1901, shows a fairly useful Hungarian remount, which was a rare exception among the equine rubbish that was sent out. He was rather straight on his pasterns.

In good Hungarian studs, the brood mares and their foals are kept in paddocks, and, if thought necessary, are housed at night. The yearlings, after the colts have been castrated, are turned out about March, with the two and three year-olds, on the open *puszta* (*veldt*) by the *csikos* (cow-boys), who generally ride old barren mares, and keep the animals together with their long whips. The young stock have to live off what they can find during

Fig. 535.—Hungarian Cavalry remount.

their outing, which lasts till October, and they and their *csikos* have no artificial shelter. The man gets a weekly supply of bread, bacon and salt, but rarely a warm meal, except when he kills some game and roasts it for himself. The climate during summer and autumn in those parts is very hot and dry. In October, the herd is driven home, housed at night, and kept in paddocks during the day. The *csikos* give a particular name to each youngster, who begins to recognise it in a remarkably short time.

When housed, each colt and filly is tied up to the manger in one particular place, and it soon learns to find its alloted spot. If it is not in its place, the *csikos* call out its name, and by flicks of the whip, drive it into its proper abode in a very short time. When they are all correctly placed, they are tied up and fed for the night, and in the morning

Fig. 536.—Hungarian farmer's horse.

are turned into the paddocks. This routine is observed until spring comes round. During this winter course, each of them gets hay and from 3 to 6 litres (5¼ to 10½ pints) of corn. Towards the end of the year, the three-year-olds are taken up, broken to saddle and harness, and are generally put aside for sale to dealers who visit these well-organised studs.

Hungarian peasant farmers conduct their horse breeding operations in a very rough manner. The colts and fillies begin carting and ploughing, when two years old, and are made to fully earn their scanty food, which consists of anything that comes handy, except oats and hay. Maize and oat straw are largely employed as a food for horses in Hungary. If the peasant farmer becomes tired

Photo by] [M. H. H.

Fig. 537.—Hungarian remount in South Africa.

of his horse, or has no further use for him, he sends him to the nearest horse-fair.

There are many places in Hungary, where fairs are held several times annually, but most of the equine material at these fairs is of inferior quality. The Hungarian farmers who breed the best horses, are those who live near Government studs, from which they can obtain, at a very low covering-fee, the service of thoroughbred stallions of English descent. The young stock thus obtained, are often 16 hands high, and of course fetch better prices than commoner-bred horses.

Polish Horses (Fig. 538) resemble Hungarian horses, but are not so strong, and consequently they are better suited to carry Ulans than heavy dragoons. They average about 15.2 in height and have plenty of blood, action and spirit. Polish ponies, which are usually

Fig. 538.—Polish Cavalry remount.

greys or bays, are very hardy and enduring, and seldom cost more than £5 each. The one shown in Fig. 539, was bred near Cracow.

Italian Horses.—We learn from de Simonoff and de Moerder's *Races Chevalines*, that Italy possesses fewer horses than any other country in Europe, with the exception of Portugal and Spain; in fact, there are only about two horses to every hundred inhabitants. Although Italy was never a very great horse country, it had, during the sixteenth and seventeenth centuries, the well-known Neapolitan breed, which were descendants of imported Spanish horses of the race that originated the Austrian Kladrub breed (pp. 508 and 526). At present, Italian horses are in a very degenerate and neglected condition, although there are a few studs in Italy which produce thorough-breds and half-breds. The only characteristic

Fig. 539.—Polish pony (14 hands).

native breed of Italian horses are the *ponies of the island of Sardinia*, which closely resemble those of the adjoining French island of Corsica. They vary in height from about thirteen to fourteen hands, are generally of a bay colour, are strong and very hardy, and are brought up in a semi-wild state. Many of these ponies are annually exported to the mainland of Italy, where they are highly prized. Although they are usually employed in two-wheeled traps, they are good in saddle. The favourite hunters of the late King Victor Emmanuel were Sardinian ponies.

In Italy, there are no heavy cart-horses, the work of which is done by bullocks and mules. For light work, the

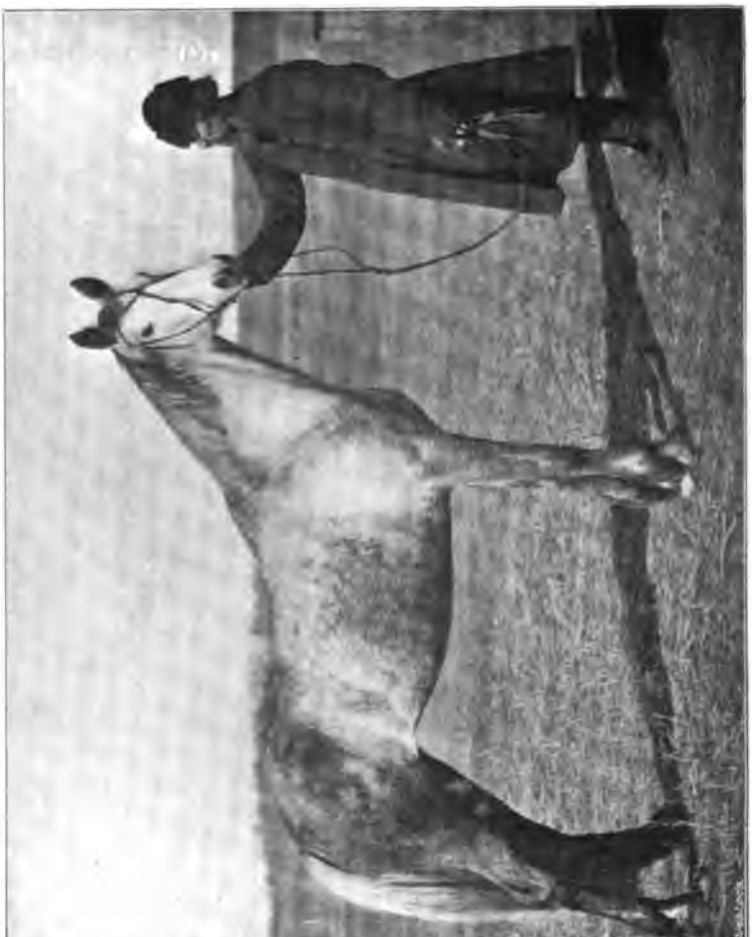

Fig. 540.—An ordinary Orlov trotter.

Italians prefer donkeys. In 1890, the estimated number of the equine family in Italy was : horses, 720,000 ; mules, 300,000 ; and donkeys, 1,000,000.

Russian Horses.—Russia in Europe contains about

22 millions of horses, which number shows that there are at least 26 horses to every 100 inhabitants of that country. This equine percentage is about three times as large as that which exists in England. While I was employed by the Russian Minister of War at the Russian Remount Depôts and in St. Petersburg, I had very favourable opportunities for studying Russian horses,

Fig. 541.—Russian match trotter.

and for seeing the great interest which their agricultural owners take in them. We are all aware that Russia is an agricultural, not a manufacturing country. When discussing the present subject, I shall largely avail myself of notes and photographs taken from *Among Horses in Russia*, which is a book I wrote on my return to England from that country.

Following the expert teaching of de Simonoff and de

Moerder in *Races Chevalines*, we may divide Russian horses into (1) stud horses, (2) agricultural horses, (3) horses bred on the steppes under improved conditions, and (4) half-wild horses.

Stud Horses.—The best known breed of this class is the Orlov trotter, which was founded by Count Alexis Orlov-Tchestmensky, whose doings with

Fig. 542.—Russian match trotter.

Peter III. and the unhappy Princess Tarakanova are told by Castéra in his *Histoire de Catherine II.* After Catherine had discarded Gregory Orlov in favour of Potemkin as her official lover, Alexis had the satisfaction of knocking out one of the eyes of his brother's rival, and then sought distraction in breeding horses. Before the formation of his stud at Khrenovoya in the government of Vononej, which is to the south of Moscow, there was no breed of horses specially known as Russian trotters, the great founder of which was a horse called Smetanka, that was imported from Greece into Russia in 1775. Russian authorities describe Smetanka as a pure-bred Arab, but Sanson (*Traité de Zootechnie*) and other French writers incorrectly allude to him as a

Fig. 543.—Old type of Orlov match trotter.

Barb. United with a Danish cart mare, Smetanka sired the stallion Polkan, who in 1784 sired Barss, whose dam was a strong-built Dutch mare. All the Orlov trotters are descended from the three sons of Barss: Lubeznoy, Dobroy, and Lebed. The dam of Lubeznoy was by an Arab out of a Mecklenburg mare. The dam of Dobroy was a thorough-bred English mare; the dam of Lebed (Nevinnaia) was by Felkerzamchik out of a

Mecklenburg mare; and Felkerzamchik was by Smetanka out of a thorough-bred English mare. The Dutch dam of Barss came from a breed which was famous for its trotting powers, and which had a good deal to say to the formation of the old Norfolk roadster (p. 522). Polkan's Danish dam is described as strong and large-boned; and Barss, as a muscular horse with elegant trot-

Fig. 544.—A troika.

ting action. Count Alexis had at his stud in 1772, the following varied assortment of animals:—

English..............	20	stallions and	32	mares.
Arab................	12	,,	10	,,
Persian..............	3	,,	2	,,
Dutch	1	,,	8	,,
Danish	1	,,	3	,,
Mecklenburg	1	,,	5	,,
Miscellaneous	9	,,	17	,,

As might be expected from their breeding, the Orlov trotters are of no distinctive type, and are divided into heavy and light trotters. The majority of them indicate the possession of vulgar relations, by their large and hairy fetlocks, fiddle heads and goose rumps. As usual, the cart strain comes out in the head, legs and setting-on of the tail; and the Eastern blood, in the body. Fig. 540, shows an Orlov trotter of fair harness type, though not of high class. With inherited trotting faculty, long legs, and light and short body, many of them can trot at a great pace, but they are poor stayers. They admirably suit the requirements of fashionable Russians, who love to go as fast as their coachman can drive them, even over the roughest cobble stone pavement, which of course does not suit the big fetlocks. They rarely stand more than a couple of years of this kind of work, and then they gradually descend towards the cab rank. As a rule ordinary carriage horses of this blood stand over 15.3, are black, and are probably allied to the funeral horses which are imported into England (p. 515).

Match trotting is greatly patronised by the Russian public, who, in St. Petersburg, assemble on the stands of the famous trotting ground of the Semenovsky Platz in large crowds, every Sunday and on other occasions throughout the winter, to witness the races that are run there. Some of the match trotters are very fast from a European point of view, and have got inside 2 minutes 20 seconds for a mile. Russian trotting men are bitterly jealous of the American professionals who have settled in their midst, and who make a good living out of the game. For this, the Yankees deserve an immense amount of credit, because Russians are staunch Tories and are devoted supporters of protected interests. Almost all the horses which compete in these races, have been bred in Russia, and show more or less admixture of American and English blood (Figs. 541 and 542). Foreign horses are admitted to very few events, and then only under severe restrictions. The old type of Orlov match trotter

(Fig. 543), though not so fast, was much stronger and a far better stayer than the modern record-breaker.

Russians usually drive in a *troika* (carriage with three horses Fig. 544), in summer, and in a sledge (Fig. 548) in winter. The centre horse of a troika is supposed to trot, and the other two to canter; the near horse leading with

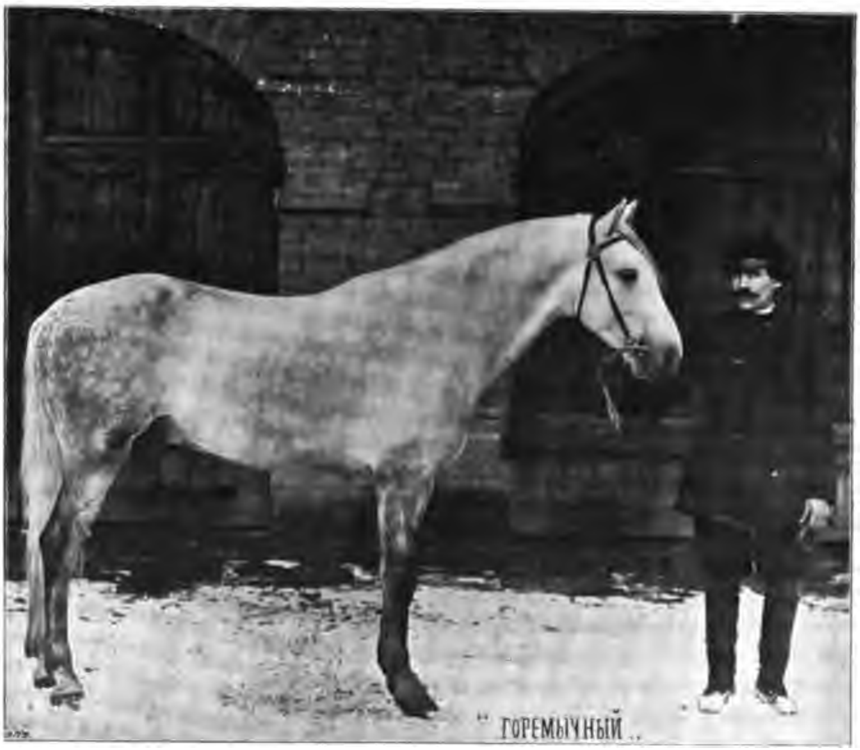

Photo by] [L. O. GORODETZSKY, TZARSKOE, SELO.

Fig. 545.—Well-bred Orlov trotter.

his off fore, and the off horse with his near fore. To make them respectively lead in this manner, the head is kept in an outwardly inclined position by means of a side-line. This style of going is considered in Russia to be the best for horses, in harness, to guard themselves against the attack of wolves.

A few of these trotters are of a good harness type;

being on comparatively short legs, and showing a dash of Arab blood (Fig. 545). The majority of this kind are grey. On first seeing them, I thought they were a distinct variety of Russian horses, but could obtain no data in support of that conjecture. In Russia, it is not the custom to add carriage horses to the list of geldings.

Count Alexis Orlov formed a breed of Orlov saddle horses, principally by crossing Arab with English thoroughbred horses, and also by using Danish and Dutch blood, with a dash of native strains. The patriarch of this breed was the chestnut Arab, Saltan, who was the sire of the bay Saltan II. (out of an Arab mare), and the grand-sire of Alexis's favourite hack, Svirepoi II. The dappled bay Yachma, who was the son of Achonok and the grandson of Svirepoi II. was the great sire of Orlov saddle horses for many years in the Khrenovoya stud, and thus played a part similar to that which Barss performed in the production of Orlov trotters.

Count Alexis Orlov died in 1810, and his daughter sold the stud to the Russian Government for eight million roubles in 1845. From this Orlov stud, all the other Russian trotting studs were formed. De Simonoff and de Moerder, both of whom are high officials in the Russian Government studs, say that the pure Orlov breed is not now maintained in Russia. Prince Nicolas Sherbatov, who is one of the great leaders of agriculture in Russia, most kindly directed my attention to this mistake, which I also recognised, when I stayed with Colonel Ismailov at the Grand Duke Dimitry's Doubrovka's stud, of which he was in charge. The Grand Duke Dimitry purchased the country around Doubrovka from the Derfelden family, and formed a stud there in 1888 with pure Orlov trotters, pure Orlovo-Rostopchin saddle horses (Fig. 548), English thorough-breds, and pure Ardenne farm horses of the mountain type (p. 500).

Count Rostopchin, who was a contemporary of Count Alexis Orlov, was his great rival in horse-breeding. He commenced operations at Voronovo, near Moscow, then went to Orel, and finally settled in Voronej. He bred only from English thorough-breds and Arabs. His stud was also bought by the Russian Government and was mixed with the Orlov saddle horses, which had been produced almost entirely from Arabs and English thoroughbreds, with a dash of Danish. Therefore the saddle

Photo by] [J. DELTON, PARIS.

Fig. 546.—Bookaretz, a Russian-bred Arab stallion of Streletsk (15.2).

horses of Russian Government studs are known as the Orlovo-Rostopchin breed. These animals are bred more for show than for hard work.

Arabs (Fig. 546) are bred at the stud of Streletsk, which is in the province of Kharkov; and thorough-bred English horses, at the studs of Derkool (which is also in the province of Kharkov), and in Yanovo, which is in Poland.

Agricultural Horses.—The only Russian heavy draught-horse is the *Beetewk*, who derives his designation from the river of that name which flows past the Voronej village of Shukavka. In 1712, Peter I. was so much impressed by the good quality of the horses of that neighbourhood, that he had Dutch stallions imported, so as to improve the breed, by crossing them with local mares. Later on, the Beetewks received a dash of Orlov trotting blood, from Count Alexis's stud at Khrenovoya, which is about 60 miles from Shukavka. Subsequently these horses were bred in private and Imperial studs, and also by peasants, chiefly of the provinces of Voronej and Tambov. On page 402, we read that the Beetewks are not such fine heavy draught-horses, as they were formerly, on account of the rich pasture land having become converted, to a great extent, into arable land.

Beetewks stand about 16.1 high and are of the true agricultural type, like the old Irish and old Welsh cart horse. "Beetewks are very strong, energetic, enduring, quiet and obedient. Their paces are good, and many of them are capital trotters, which fact enables them to be used, not only for heavy draught, but also for light harness work, such as coaching. On account of the possession of these physical and mental qualities, they are much more useful in Russia, than foreign heavy draught animals, especially because their bodies are not so weighty, which is a great advantage on the unmetalled roads of Russia. Although not heavy, they are very strong, and can pull 3 tons or more. Also, the Russian character is shown by their high spirit and speed. The most important point of all, is the fact that their working utility has been incontestably proved by experience, but that of their foreign rivals has not yet been demonstrated. Percherons and Clydesdales have failed to justify the hope we placed on them; and now we are trying Belgian Ardenne horses. It would be much safer for us to follow the advice of the Russian proverb which tells us not to lose the good, by seeking the better" (*de Simonoff and de Moerder*).

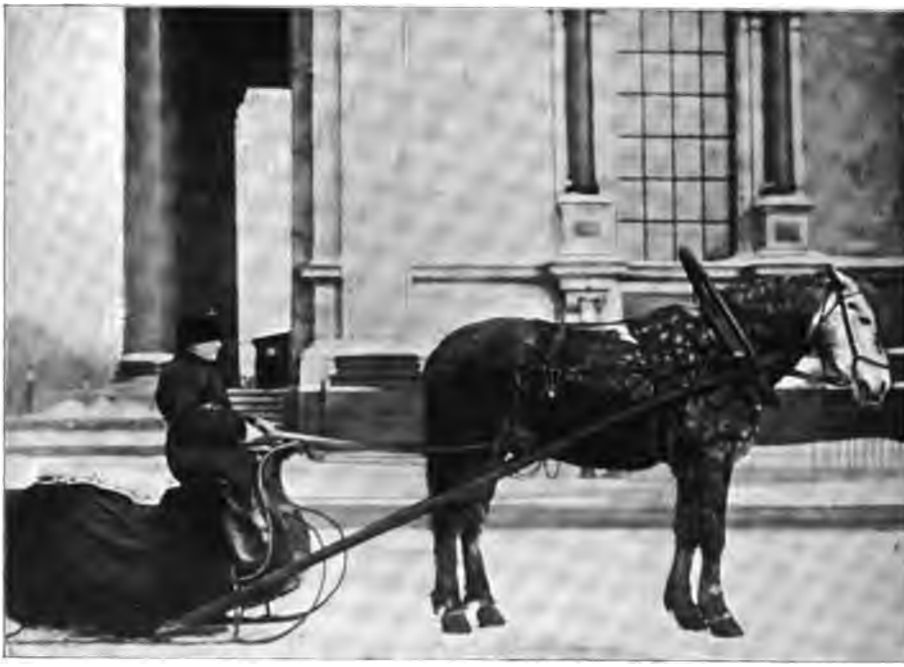

Photo by] [M. H. H.

Fig. 547.—Large type of Finnish pony.

Photo by] [M. H. H.

Fig. 548.—Small type of Finnish pony.

The other agricultural horses consist of light cart horses and ponies, both of which are thoroughly good workers. We learn from *Races Chevalines* that out of the 19,000,000 agricultural horses in Russia, only about 1,000,000 belong to special breeds; the remainder being chiefly cross-breds from the steppes. Kleppers of Esthonia, Finland horses, and Viatkas are distinctive representatives of the six or seven special breeds.

The *Kleppers* are bred in the Baltic provinces of Esthonia and Livonia and in the islands of Oesel and Dago. They appear to be descended from native ancestors which were crossed with Eastern blood. They vary in height from about 13 to 15 hands, are good-looking, strong, enduring, and many of them are fast trotters.

The *Finland horses and ponies* (Figs. 547 and 548) are about the same height, but are coarser looking than the Kleppers, with whom they are said, by some authorities, to be related. In Russia they are called Finkas (Finns) or Shvedkas (Swedes). They are hardy and strong, but are not fast. They are largely used for cab purposes in St. Petersburg.

Viatkas (Fig. 549) are a strong, hardy, fast, and good-looking breed of ponies of from 13 to 14 hands high which "are bred on the borders of the river Kama and its tributary, the Obva, in the provinces of Viatka, Perm, and in the northern part of the province of Kazan. This breed was formed by crossing native mares with Esthonian Kleppers which were imported during the reigns of Alexis Michaelovitch and Peter I. Finland blood was introduced later on. Viatkas bred on the banks of the Obva are called *Obvinkas*, which are the tallest and best variety of this breed. The smallest are the *Kazankas*, which are raised in the province of Kazan. Their height is about 13 hands. Viatkas, Obvinkas and Kazankas are sold at fairs in the neighbouring provinces of Simbirsk, Samara and Penza, as well as in the districts in which they are bred" (*de Simonoff and de Moerder*).

Horses bred on the Steppes under improved conditions.— There are many private breeding farms in the steppes of the Don, Volga, Dnieper, and other parts of Little Russia, which raise some good stock (Fig. 550), and which supply the Russian military authorities with a large number of remounts. The fifty-four dragoon regiments (cavalry of the line) require every year about 7,200

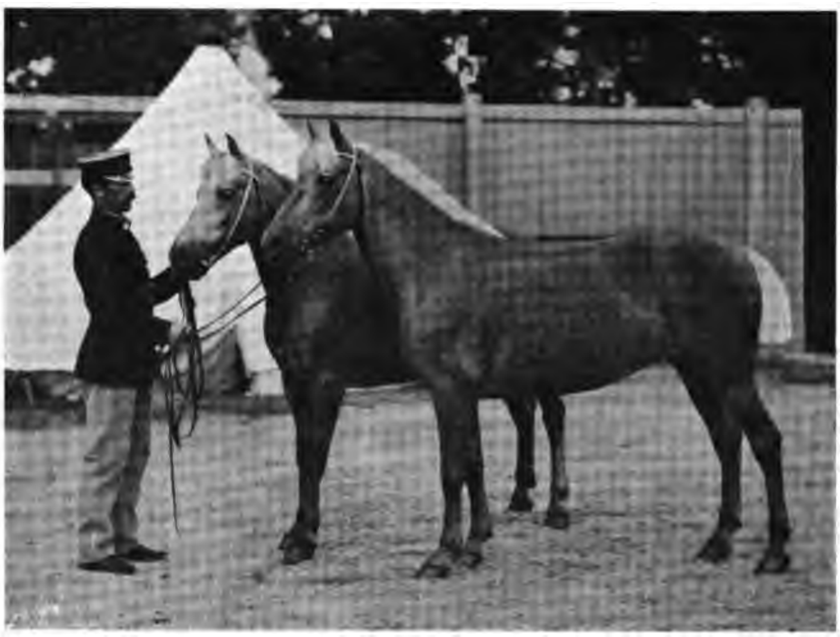

Photo by] [J. DELTON, PARIS.

Fig. 549.—Viatka ponies (13.1).

remounts, which they receive from the remount depôts of Sysran, Ostrogorchsk, Kirsanov, Liski, Balaklaya, Borisoglebsk, Tambov and Armavir, at all of which I stayed, except the first and last. The average price of these animals is about 125 roubles (£13 5s.), which mounts up to about £22 by the time they arrive at the depôts (*cadres*), and is increased to about 350 roubles (£37), before they join their regiments. They are received into the *cadres* from about the 20th September to the 6th November, and remain there for ten or eleven months. At the time of purchase, these remounts vary in age from 3 off to rising 5, and must be at least 2 archines and 1½ vershok (14.2⅝) high. Their average height when passed into the ranks is about 15.1½. They have a good proportion of Arab and thorough-bred English blood in them, are essentially saddle horses, and as they are brought up on the wild steppes, they

Photo by] [J. DELTON, PARIS.

Fig. 550.—Chestnut mare, Drazina (15.3); bred in the steppes of the Don.

are extremely hardy, and very enduring. Attention is paid to their breeding, and in winter, during which time the thermometer sometimes falls as low as −40° F., their breeders occasionally afford them shelter and give them hay; but at other times, they have to rely for food on what they can find on the plains. In their bringing up, we may compare them to horses which are raised in Australia for export to India, with of course the exception that the climate of Australia is far more favourable for horse-breeding than that of Russia.

Figs. 551, 552, and 553, are typical examples of freshly caught remounts; and Fig. 554 represents a typical well-bred Donsky remount which had been stabled for a few months. At first sight, these animals might appear to be rather light; but closer inspection

Photo by] [M. H. H.

Fig. 551.—Russian Remount.

shows that they have capital bone, are compactly built, and have no superfluous "lumber" to carry. With very few exceptions, they are entirely free from cart blood, and consequently, even if their fore legs in some cases seem rather light below the knee, the back-tendons run more or less parallel to the cannon bone, and there is no coarseness about the fetlocks, which is a distinguishing mark of a cross with Shire, Clydesdale or other heavy-draught blood, and is strong evidence of inability to stand hard work under the saddle. These Russian remounts have as a rule short backs, muscular loins, good feet, fairly intelligent heads, and are well ribbed-up. They are particularly good across the loins, which is a point that receives much attention from Russian breeders; and consequently they are long in

Photo by] [M. H. H.

Fig. 552.—Russian Remount with Arab cross.

their back ribs, as we may see by the lower line of the body being more or less parallel with the ground (pp. 232 to 236) in all these horses. Formerly the horses of the Don, from which country the best remounts are obtained, were generally "back at the knees" ("calf-kneed"), but this defect has been almost entirely eliminated by careful selection of sire and dam. The members of the committees which pass or reject the animals bought up by the purchasing remount officers (*remonteurs*), are very critical as regards the quality of the pasterns, as we may learn by the frequency with which they employ the word, *babkee* (pasterns), in the remarks they make on the young ones paraded for their inspection. On the whole, they have very good fore legs. Their shoulders are inclined to be short ; but their worst point is

Photo by] [M. H H.

Fig. 553.—Well-bred Russian Remount.

undoubtedly their hocks, which in many instances are weak. I feel certain that if the question of hocks was better understood in Russia, effective means would be taken to remedy this defect.

These remounts, especially those which come from the country of the Don, have a strong infusion of Arab blood, with a dash of the thorough-bred. They are essentially saddle horses bred for cavalry purposes. The number of horses required for our cavalry on home service, is so small that it does not pay breeders to cater exclusively for the army. Consequently, our remount officers have to take misfits from the hunter and light harness classes, with the result of lack of uniformity, and a very undesirable admixture of the harness, if not of the cart blood element. Thus, among a large number of cavalry horses in

Fig. 554.—Good type of Donsky Remount.

England, we find that many of them are too heavily "topped," for the quality of their legs. In making a comparison between the cavalry horses of the two countries, we must take into consideration that the Russian horses are reared under conditions of privation and hard work to get their living, and are consequently more useful as slaves and campaigners than they might appear to uninstructed eyes; but the opposite to this may be said about our home army horses, which I am convinced are inferior to Russian troopers, for active service. When we turn to India, the case is entirely different; because there, our men are mounted on Australasian horses, which are bred chiefly for the Indian saddle-horse market, under

Photo by] [J. DELTON, PARIS.

Fig. 555.—Circassian horse (15.½).

conditions that are far more favourable to horse development than those which exist in Russia.

Amongst the many other breeds of horses which are foaled and reared on the steppes of Russia, the Circassian horses (Fig. 555) are of the most Eastern type. They come from the Southern district which is bounded by the rivers Aras and Kur, and are supposed to be the result of crossings between Arabian, Persian and Turkoman horses. They are usually about 14.2 high.

Half-wild Horses.—According to de Simonoff and de Moerder, the horses which come under this heading, are those of the Kalmouks and the Keergeez ; the former being bred in the southern portion of the country, between the rivers Volga and Ural ; and the latter in the steppes to the north-east of the Caspian Sea. Both are coarse bred animals, but are extremely hardy and enduring. The Kalmouk horses are about 15 hands high, and many of them are sold as remounts for the Russian cavalry of the line. The Keergeez breed are ponies which rarely exceed 14.1 in height.

On the Keergeez and Kalmouk steppes, each stallion has his *kossiak* of fifteen to twenty brood mares, which are generally chosen by the stallion and are protected by him. The young mares which have not had a foal and the geldings keep together without apparently any form of equine government. Several *kossiaks* form what is called in Russian a *taboune*, which may consist of hundreds and sometimes thousands of animals that have to shift for themselves. As these horses very rarely get any food, except what they have to pick up for themselves, they undergo terrible privations during the extremely severe winters. As their Cossack owners love to drink *koomiss*, which is fermented mares' milk, the unfortunate foals are rarely allowed to suck their dams after they have been a day or two old. Under these conditions, they naturally take a long time to mature and are seldom fit for work until they are five years old.

On all the steppes, the unbroken horses are caught by means of a lasso, which often causes severe and not unfrequently fatal injuries, and has the further serious objection that in any case it hurts, to a greater or less extent, the part of the neck which is close to the head, and consequently it renders the animal difficult to bridle, and sometimes even to approach, as I often found to my cost, when breaking recently-caught horses at the *cadres* (remount depôts). Every horseman knows that "head-shyness" is one of the worst of vices.

Swedish and Norwegian Horses (Figs. 400 and 556) are strong, hardy, and rather small animals which closely resemble Finnish ponies. They are generally better for harness than for saddle, and many of them are good

Fig. 556.—Mr. Helgesen's Norwegian pony.

trotters. The horse-breeding industry is mostly in the hands of small farmers, although "in Sweden there are some studs where thorough-breds and half-bred English horses are raised" (*de Simonoff and de Moerder*). These authors state that in 1890, the equine population of Sweden amounted to 638,302; and that of Norway, 150,873.

CHAPTER XXXI.

AMERICAN HORSES.

Cow-ponies and Range Horses—U.S. Draught Horses—U.S. Thorough-breds and Half-breds—U.S. Carriage Horses—Trotters—Pacers—South American Horses.

WHEN the Spaniards first went to America, they found no horses there, and the natives they encountered did not possess any knowledge whatsoever about these animals. Consequently, the general opinion is that all American horses are descended from imported horses. Some authorities maintain that native horses existed in South America at that time; but, as pointed out by Mr. McConnell (*Agricultural Geology*), the only evidence in support of this assumption is, apparently, Sebastian Cabot's map (1527–1547). Against this map theory, we have the important fact, which was pointed out to me by Mr. Cecil Gosling, H.B.M. Consul for Paraguay, that "no original equivalent for the word, horse, exists in the Guarani language, which is spoken by the Guarani tribe in Brazil, Corrientes and, I believe, in Bolivia. The Guarani are the chief race of the South American continent. Their language is exceedingly rich, and possesses names for every indigenous flower, fruit, tree and animal in the country. The Guarani name for horse is *Cavajú*, which is evidently derived from the Spanish word, *Cavallo*."

After horses were imported from Europe, they increased in number so rapidly, owing to favourable conditions of life, that both North and South America became filled with innumerable herds of wild horses.

Colonel Cody (*The Sandringham Magazine*) tells us that

" after Cortez had conquered Mexico, horses of the Arabian breed were imported from Spain. Various herds of these escaped from the southern portion of the continent, and ranged throughout the vast plains of the north-west. These herds are the ancestors of the wild horses of to-day. Their size, throughout the intervening centuries, has varied according to the fertility or barrenness afforded them by the nature of the grazing facilities which the

Fig. 557.—Chestnut cow-pony (broncho); 15 hands.

various sections supply. On the barren ranges of the south, the animals are much smaller in stature, and are called ' mustangs.' On the great grass plains of the central section of the continent, where there is an abundance of fodder and water, the animals become larger, more vicious, and possessed of much greater stamina. These animals have from time immemorial borne the appellation of ' bronchos.' Further away to the north, amid the snows of the mountain ranges of Canada, these horses in their wild state are known as the 'cayuse.' The further north these animals are found, the more fierce and vicious they are in their natural, wild state. This is undoubtedly caused by the pressing necessity of defence for themselves and their offspring."

From the beginning of the seventeenth century, horses were abundantly brought into America from Holland, England, France and other countries, with the object of

Fig. 558.—The Hon. W. Anson's Texas polo pony, Rondo.

establishing and improving various breeds. Thoroughbreds began to be imported about the middle of the eighteenth century.

U. S. Cow-Ponies and Range Horses.—Cow-ponies (Fig. 557) are the oldest type of horses in the United States. Dr. Joseph Parker, D.V.S. Inspector in the Bureau of Animal Industry, U.S., who most kindly sent me the photograph for this illustration, tells me that this horse is of a sorrel (yel ow dun) colour, has a light-coloured mane and tail, carries a typical cowman's saddle and is a fair specimen of the old time Texas broncho (cow-pony), the original type of which is fast disappearing, on account of copious admixture of foreign blood. These animals were rough, angular, heavy-boned ponies, and stood from 14.2 to 15.2 high. They were "range bred and half-wild," and were noted for their viciousness, intelligence and

Photo by] [M. H. H.

Fig. 559.—Kansas remount in South Africa.

endurance. In the States, the word, "pony," seems to be used in a less restricted manner than in this country. Many "improved" cow-ponies make excellent polo ponies (Fig. 558).

"When animals are sold on the market as 'range-horses,' it is generally understood that they are unbroken branded horses brought in and sold in cartload lots, usually going to the country to be broken, and finally resold as finished horses. On the other hand, if range men are equipped to break their young stock thoroughly and do not brand them, such horses sell as natives, and strictly on their merits. It is safe to state that the character and disposition of the range horse and his individuality are being greatly improved by the enlightened policy of the more progressive ranchmen. His temper is being bettered by closer communication with man and better methods of handling, and the standard of breeding is

Fig. 560.—Texas cob (15 hands).

being raised by the use of large numbers of pure-bred sires that have been brought in from the Eastern States and Europe. At the same time, the wonderful quality and endurance of the native stock have been retained, and, however we may look upon the range horse personally, we must admit that the foundation is there for a very excellent horse stock. It cannot be said that even a large part of the range horses sold on the western markets show much evidence of breeding. The work of improvement is yet in its primary stages" (G. M. Rommel's *Market Classes of Horses*).

Many range horses (Figs. 559, 560, 561 and 562) made serviceable remounts for our army in South Africa during the late Boer war. Fig 560 shows a range horse which was being examined for that purpose. In Fig. 563, we see an admirable type of useful range pony, which would make an excellent mounted infantry animal.

Fig. 561.—Texas cob (14.3).

U. S. Draught Horses.—Mr. Rommel, who is an Expert in Animal Husbandry, states that heavy cart-horses are extremely rare on the American market, and when found, are not always of the best quality. American van, omnibus, and tram horses are of a useful type, and are largely employed on English streets.

U. S. Thorough-breds and Half-breds.—These animals do not differ much from English horses of the same class. Hunting is becoming popular in America, and there are many good jumpers in that country. For instance, Mr. Willets' Heatherbloom made a record high jump of 7 feet 8 inches.

U. S. Carriage Horses.—Of late years, high stepping, showy carriage horses have become greatly prized in the States. We read in the *New York Herald* that Mr. Thomas

Fig. 562.—Mexican horse.

W. Lawson gave $10,000 (about £2,050) for the "heavy harness horse," Red Cloud. This animal, like almost all the other fashionable American carriage horses, has a great deal of trotting blood in him.

"When the National Horse Show was established and for several years afterwards, popular belief credited the English hackney with exclusive ability to fold his knees and flex his hocks in the extravagant style required to get the ribbons at the Garden. Admirers of the trotting horse then ridiculed the imported high stepper in unmeasured terms, little dreaming that in less than a decade they would be cultivating just this type themselves, and bragging that their native trotters could ape the fashionable hackney to perfection.

"It was not until 1894 that some one discovered in John A. Logan's prize-winning high stepper, The Devil's Deputy, a well-bred trotter disguised as a hackney. This

Photo by] [M. H. H.

Fig. 563.—Mr. W. H. Walker's Montana pony, Montana Bill (14.1).

horse defeated Joseph E. Widener's imported hackney mare, Dorothea, in one of the open harness classes at Madison Square Garden. The disclosure caused quite a stir in the horse world and the winner was regarded as a freak. Shortly afterwards the fact came out that all the high steppers exhibited at the National Horse Show by Charles F. Bates were trotting bred.

"Since 1895 the trotting bred carriage horse has dominated the show ring and the sale mart. Every champion high stepper of the National Horse Show since that date has been the offspring of a trotting sire, except in two instances, where the blood of the winners was unknown.

"Extraordinary prices for fashionable carriage horses have caused the destruction of many valuable stock horses that could ill be spared from the breeding ranks and the retirement from the turf of some noted performers. One of the fastest trotters ever converted into a high stepper is Doctor Pitzer, a brown stallion, by Arsaces, son of Alcyone, 2.27, that gained a record of 2.12½ in a race at the Boston Grand Circuit meeting in 1899. Judge William H. Moore paid $9,000 for this grand looking horse, and he is now to be seen nearly every day in Central Park, docked and a gelding, in heavy harness" (*New York Herald*).

Respecting the American method of making imitation hackneys, Dr. A. G. Hopkins, D.V.S., writes to me as follows: "During a winter's stay in Chicago, where I did post-graduate work with Dr. M. H. McKillip, who is the leading veterinarian in that city, I helped in several of these operations. Standard-bred stallions, often with marks of from 2.40 to 2.25 are procured and castrated. Later on they are docked and their tails set up by nicking; and when they get great growth of foot and plenty of iron, they can pull their knees up to their chins. The Anglomaniac gets caught, for he knows nothing about horses. The imitation hackney seldom bends his hocks properly, and when he is pushed, he often spraddles, as the trotter does in the sulky."

Trotters.*—The first step towards the formation of the American trotter was the importation, in 1788, of Messenger, who was in the English thorough-bred Stud

* I have compiled almost all the facts contained in the following remarks on American trotters and pacers from the notes and press cuttings most kindly sent me by Mr. Francis A. Foster, of Boston, who has had great experience among these animals.

Book, and who contributed a large share of the blood inherited by Rysdyk's Hambletonian, as we can see by the accompanying pedigree table :

- Abdallah No. 1.
  - Mambrino, by imported Messenger.
  - Amazonia (a trotting mare).
- Charles Kent mare (a trotter).
  - Bellfounder (imported Norfolk trotter).
  - One Eye.
    - Bishop's Hambletonian.
      - Messenger.
      - Unknown mare.
    - Silvertail.
      - Messenger.
      - Unknown mare.

Rysdyk's Hambletonian No. 10.

Bellfounder was brought from England about the year 1820, by a rich manufacturer named Boott, who advertised him as a Norfolk trotter that was capable of trotting 17 miles in an hour with 14 stone up.

Rysdyk's Hambletonian (Fig. 564), who is the great modern progenitor of fast trotters, is supposed to have inherited much of his peculiar shape from Bellfounder. He was 23 years old, when his photograph was taken in 1872. Consequently, he looks somewhat out of shape, and his back has sunk with age. Also, the photograph has been evidently "faked."

We learn from the *New York Herald*, that "Rysdyk's Hambletonian was foaled in 1849 at the little village of Sugar Loaf in Orange County, N.Y., and began his career as an obscure cross roads stud horse. Jonas

Seely, the Old Bull's Head cattle drover, who bred him, sold colt and dam for $125 in the fall of 1849 to William M. Rysdyk, then a farm hand in Seely's employ. It was not until 1862 that the great son of Tredwell's Abdallah and the Charles Kent mare gained a reputation sufficient to justify William M. Rysdyk in raising his stud fee above $35. Robert Fillingham, afterwards known as George Wilkes, 2.22, was the trotter that earned it for him. In that year 'Eph' Simmons matched this son of Hambletonian against the famous Ethan Allen for $5,000 a side, and won a great race over the Fashion Course on Long Island, giving his young horse a mark of 2.24¾, which was then surpassed only by George M. Patchen's champion stallion record of 2.23½.

"Dexter, by Hambletonian, began his brilliant career in 1864. Shark, another son of Hambletonian, that once defeated Dexter, came out in the same year. The next season brought to the front Goldsmith Maid, by a son of the Rysdyk horse, and with all four of these great trotters going at once, the great Hambletonian boom began. Beginning with the advent of George Wilkes in 1862, his stud fee jumped to $75, and then to $100, $300 and $500 in successive seasons, and his colts commanded prices until then unheard of for horses of any type in America.

"Hambletonian died in 1876, having begotten about 1,333 foals. Forty of them gained trotting records of 2.30 or better. One hundred and fifty of his sons got 1,478 trotters of standard speed, and eighty of his daughters produced 110 trotters in the 2.30 list. In the succeeding generations, the achievements of the family are still more remarkable, and it is estimated that nearly if not quite 15,000 of the 17,625 trotters in the 2.30 list are descended from the 'old hero of Chester,' through either sire or dam, or both. Since Dexter's day, every trotter save one that has lowered the world's record has carried the blood of Hambletonian. The exception is Rarus (2.13½), whose sire was of unknown breeding. At the close of the campaign of 1901, 138 trotters had earned records of 2.10 or better. Of this number, no less than 135 traced to Hambletonian. . . . . . Judged by the cold statistics of the 2.10 list, none of these crosses equals in fruitfulness in breeding to Hambletonian. The most successful horsemen have doubled and redoubled in their studs the blood of

Photo by] [SCHREIBER & SONS, PHILADELPHIA.
Fig. 564.—Rysdyk's Hambletonian.

the world famous trotting progenitor, and the greatest of trotters have resulted from this course. Cresceus (2.02¼), the champion of champions, traces to him through both sire and dam, as did Alix (2.03¾), and Nancy Hanks (2.04), the champions of a few years ago."

Hambletonian earned $288,000 at the stud.

Mr. Peter C. Kellogg, who is a prominent American horse authority, measured him when this horse was 25 years old, and found that he was 15.0¼ high at the withers, and $15.2\frac{1}{4}$ over the croup. During his younger days, it was generally stated that he was $1\frac{3}{4}$ inches higher behind than in front. None of Hambletonian's stock which closely resembled him in appearance, proved eminent either at the stud or on the track, for he was a long horse, and all his fast progeny were short in the body. His chief peculiarities were: great muscular power, small and round body, and low withers, which appeared sunk between the tops of his shoulder blades. Although Hambletonian transmitted the trotting faculty to many of his descendants, he did not possess it himself. Mr. Francis A. Foster, who knew Hambletonian, tells me that "the stories of his having trotted a mile in 2.42 as a 3 year-old, are a myth. I have read hundreds of pages of these yarns, but I have never known a man who had practical knowledge of this sire, that believed he was able to trot a mile in 3.15. The stock of Rysdyk's Hambletonian were not only unstable in conformation, but they also varied in size from ponies to giants."

After the Hambletonian, the Mambrino Chief strain is the most successful trotting one, and then comes American Star, Clay, Pilot, Morgan, Vermont Black Hawk, Bashaw, and others. Mambrino Chief was foaled in 1844 and died in 1861. He was the grandson of Mambrino by imported Messenger, and his dam was of unknown blood.

American Star is believed to be descended in the male line from imported Diomed, who was the first winner of the Derby (1780). Although many of the American Stars are handicapped by unsoundness and lack of height, they possess such a large amount of speed at the trot, that they cannot be ignored from a record-breaking point of view. For instance, the champion, Lou Dillon (Fig. 565), and the ex-champion, Cresceus (Fig. 566), have a cross of this blood.

The Clays are descended from Henry Clay, who was a fast trotter that was foaled in 1837. His sire was Andrew Jackson, who was a well-known trotter, and was a grandson of the Barb, Bashaw. Henry Clay's dam was a famous trotter, but of unknown pedigree. The Clays have lately fallen off in trotting popularity, chiefly because they are considered to be somewhat faint-hearted.

The Pilots are descended from a Canadian pacer called Pilot.

Vermont Black Hawk was a Morgan stallion. Mr. Foster tells me that the Vermont Black Hawks are the

Photo by] ["AMERICAN HORSE BREEDER."

Fig. 565.—Mr. C. G. K. Billings's five-year-old chestnut mare, Lou Dillon (2.00), champion American trotter; stands 15.1 high. Millard Sanders driving.

handsomest, most persistent and best-gaited of all trotters, but not the fastest. He considers them the best road horses in the world. Their only fault is that, like other Morgans, they are too small to fetch high prices. As a rule they stand from 14.2 to 15 hands. Those who knew Ethan Allen (2.25½), who was by Vermont Black Hawk, say that he never had a superior for beauty and style of going. He did a mile in 2.15, when hitched to a wagon alongside a running mate.

The origin of the Bashaws is traced back to Young Bashaw, whose sire was the imported Barb of that name, and whose dam was a thorough-bred. His grand-dam was by imported Messenger.

The Long Island Black Hawks (which are not related to the Vermont Black Hawks) and the Blue Bulls have practically disappeared from the track.

"The Morgans are perhaps our oldest trotting family; and if they have not produced our very fastest trotters, their produce undoubtedly deserve to take the very highest rank as good-tempered, hardy and pleasant roadsters. They are descended in the paternal line, from a horse called Justin Morgan, that was bred in Vermont, foaled 1793, and died 1821. His blood has never been positively known, although it is pretty well established that the thorough-bred predominated. . . . . Go where you will among livery-stable keepers or horse-railroad managers, and ask them what type of horse they have found most profitable to use and wear out on the road, and they will almost invariably answer, 'the old-fashioned Morgan'" (*Sanders*).

As the typical American trotter does not seem to have more thorough-bred blood than an average English or Irish hunter, who has no possible claim to be a race-horse; the extraordinary speed of the American trotter at his own particular gait, cannot be derived from the thorough-bred, who is by no means fast at the trot. The subject of the influence of thorough-bred blood on the American trotter, has been ably discussed in the *County Gentleman*, by Mr. L. M. Payne, who tells us that "the fastest trotting records at the close of 1902, do not give the advocates of running blood in the trotter much comfort. The records show that there are only ten trotters which have trotted faster than 2.06. They are Cresceus (2.02¼), The Abbot (2.03¼), Alix (2.03¾), Nancy Hanks (2.04), Azote (2.04¾), Directum (2.05¼), John A. McKerron (2.05¼), Major Delmar (2.05½), Lord Derby (2.05¾), and

The Monk (2.05¾). Every one of the ten trace closely to Hambletonian, some several times. Eight of the ten trace also to Mambrino Chief, some a number of times. There is not one whose dam or grandam is a running-bred mare. There is but one, Azote, which is sired by a stallion that has a running mare for a dam. Whips, his sire, is a son of the great Electioneer, out of a running mare, but Azote traces three times to Hambletonian, once through

Photo by] [BAKER ART GALLERY, COLUMBUS, O.

Fig. 566.—Mr. George Ketcham's Cresceus (2.02¼).

his sire and twice through his dam. This trotting blood was strong enough to neutralize the running blood he received through his sire's dam.

"These fast records plainly show it is a wiser plan to breed to the fast-bred trotting blood, that which has produced the fastest trotters, than to breed to stallions that have a large percentage of running blood close up. A little running blood far removed may not entirely eradicate the trotting instinct. But if a large proportion of running blood destroys the trotting inheritance, why is a little good ?"

Mr. J. H. Sanders wisely remarks in his well-thought-out book, *Horse Breeding* (1893): "In no department of stock-breeding is the influence of heredity and of patient selection with a view to the transmission and improvement of a desired quality more apparent than in the breeding of the trotting horse. Sixty years ago the American trotting horse, *as a breed*, was unthought of; and one that could trot a mile in less than three minutes was a wonderful animal! But the ability to trot fast was a desirable quality and breeders sought to perpetuate it. . . . The experience of the last decade has demonstrated beyond question that by confining our selections for breeding purposes to the descendants of the well-known trotting families, the possibilities of producing fast trotters are infinitely greater than by going outside. . . . In almost every case of 'breeding unknown,' we have found that the dam was a 'fast trotter.'"

In order to keep the attention of my readers as closely as possible to the special subjects of this book, I have carefully refrained, up to the present, from touching on the subject of breeding; but the extraordinary success of interbreeding in the case of Hambletonian, forces me to depart from the rule which I have hitherto observed, especially as a cutting from an American newspaper (*The New York Herald*, I believe), contains extremely valuable remarks on this very interesting subject. In England, breeders of all kinds of animals are aware that their adoption of close interbreeding is generally accompanied by loss of vitality and of fertility, although it has a strong influence in establishing special characteristics and uniformity of type; but few are aware that the drawbacks in question can be obviated to a great extent by change of environment. This is well explained by the American writer, who tells us that "Darwin long ago gave it as his opinion that the injurious effects of close interbreeding may be checked or quite prevented by separating related individuals for a few generations, and exposing them to different conditions of life. He even went so far as to say that consanguinity in itself counts for nothing, but produces its evil effects solely from the fact that related animals generally have similar constitutions, and are usually exposed to similar environments. This conclusion is now held by many breeders, and the records of turf and stud are full of facts which seem to bear it out. Representatives of the Hambletonian family are widely distributed all over the country, from Maine to California, and from Minnesota to Texas. They are exposed to the greatest variety of climatic conditions, and are being constantly transplanted from one section to another. Their blood is being freely commingled with little regard to consanguinity, and with no evidence as yet that close interbreeding is proving other than a benefit to the family." This theory is well borne out by the good effect which recently imported thorough-bred sires have had on the thorough-bred stock of Australia; and we all know that Carbine, the New Zealand son of Musket, has been a great success as a sire in England. Imported sires, such as Panic, Musket, Fisherman, and St. Albans, have produced more successful racing stock in Australia, than Colonial-bred sires, of which the best has been Yattendon, whose two most distinguished sons at the stud were Grand Flaneur and Chester, both out of imported mares. The American paper, *The Spirit of the Times*, says that "the success of imported English sires within the past twenty years, beginning with Leamington, has certainly impressed many breeders with a belief in their superiority. Glenelg, Australian, Bullet, King Ban, The Ill-used, Great Tom, King Ernest, Bonnie Scotland, Rayon d'Or, Prince Charlie, Phæton, Eclipse, St. Blaise, etc., have well nigh driven the native stallions into exile. Virgil may be said to have been the only stallion who was native-bred on both sides of his pedigree, and who has held his own against the imported horses. Longfellow, Spendthrift, Eolus, King Alfonso, and other successful native sires, were the sons of imported horses. The English mares have also succeeded in a great degree." English breeders should encourage this interchange of the same blood from distant countries.

American trotters, which sprang from horses that possessed the all-important gift of trotting, were at first but little removed from what we might call "light harness horses." By careful selection, good management, and improvements in tracks and sulkies, the speed of the trotter has steadily and rapidly increased, as we can see from the following record times for one mile :—

1806.	Yankee	2.59
1810.	Boston Pony	2.48½
1826.	Trouble	2.43½
1834.	Sally Miller	2.37
1845.	Lady Suffolk	2.29½
1849.	Pelham	2.28
1855.	Highland Maid	2.27
1859.	Flora Temple	2.19¾
1867.	Dexter	2.17¼
1875.	Goldsmith Maid	2.14
1878.	Rarus	2.13¼
1880.	St. Julien	2.11¼
1884.	Jay Eye See	2.10
1885.	Maud S.	2.08¾
1891.	Sunol	2.08¼
1892.	Nancy Hanks	2.04
1895.	Alix	2.03¾
1900.	The Abbot	2.03¼
1901.	Cresceus	2.02¼
1903.	Lou Dillon	1.58½

The following are the best trotting records from one mile to a hundred miles :—

1 mile, Lou Dillon (1903)	1.58½
2 miles, Cresceus (1902)	4.17
3 ,, , Nightingale (1893)	6.55½
4 ,, , Senator L. (1901)	10.12
5 ,, , Zambra (1902)	12.24
6 ,, , Long Time (1893)	16.08
10 miles, Pascal (1893)	26.15
20 ,, , Captain McGowan (1865)	58.25
50 ,, , Ariel (1846)	3.55.40½
100 ,, , Conqueror (1853)	8.56.01

The following are the best trotting records for one mile at ages under six :—

Yearling colt, Adbell (1894)	2.23
Two-year-old colt, Arion (1891)	2.10¾
Three-year-old filly, Fantasy (1893)	2.08¾
Four-year-old colt, Directum (1893)	2.05¼
Five-year-old mare, Lou Dillon (1903)	1.58½

Arion (Fig. 567) did his two-year-old record in a high-wheeled sulky.

American trotters would do faster time, if their courses were straight and not, as they are, elliptical.

Budd Doble, who steered Dexter, Goldsmith Maid and Nancy Hanks (Fig. 568), when they made their respective best-on-records, is said to have recently expressed the opinion that Goldsmith Maid would have made as good time as Cresceus, had she trotted under as favourable conditions as he did. Although this idea may contain a strong old-time bias, the fact remains

Photo by] ["AMERICAN HORSE BREEDER."

Fig. 567.—Mr. J. Malcolm Forbes's Arion (2.10¾ at two years old, to high wheels); stands 15.1.

that mechanical improvements greatly tend to lower records. The sulky is undoubtedly the most important factor in this connection. In the early part of last century, the sulky took the form of a light gig, which probably did not weigh less than 125 lbs. Goldsmith Maid's sulky, which was the best of its kind up to that time, weighed about 46 lbs., had wheels 4ft. 10in. in diameter, and a straight axle, which prevented a "close hitch," because, if such a sulky was brought close to the horse, the animal's hind legs would be apt to hit the axle. Consequently, the use of a vehicle of this kind greatly diminishes the speed, by increasing the horse's stability of equilibrium (p. 69). After the time of Goldsmith Maid, a great advance in the construction of sulkies was made, by the introduction of the arched axle, which allowed a close hitch, and which was first drawn

Photo by] [SCHREIBER & SONS, PHILADELPHIA.

Fig. 568.—Mr. J. Malcolm Forbes's Nancy Hanks (2.04).

on a record-breaking journey by Rarus. Its weight in his case was about 45 lbs. The sulky with which Maud S. (Fig. 569), made her record, weighed 43 lbs., had a roller bearing axle to diminish friction, and was made so as to get a very close hitch, and had high wheels. Bicycle wheels were applied to sulkies in 1892 by Mr. Stirling Elliott, who was a bicycle manufacturer, and were used by Nancy Hanks when she made her record. These wheels were an immense success, because they reduced vibration, and at the turns, they checked the tendency of the sulky to "slew." Also, the resistance of the air was much reduced by diminishing the diameter of the wheels, and thus bringing the driver lower down. To avoid "catching the wind," some of the best American drivers drive behind some other horse, until the home-stretch is reached, and then they "rein out," and win

Photo by] [SCHREIBER & SONS, PHILADELPHIA.

Fig. 569.—Maud S. (2.8¾).

if they can. The improvements in construction were so great that the sulky which Cresceus bore to victory, weighed a little less than 25 lbs. Some track wagons (which have four wheels) do not weigh more than 45 lbs.

The great development of the trotting instinct is well proved by the fact (which Mr. Foster brings to my notice) that, forty years ago, there were hundreds of American horses which could trot fast in private trials, but would break or "run" in races; and that such instances, especially in fast races, are now uncommon. Hence, persistency at the trot is as well marked a characteristic of "standard trotting breds" of to-day, as speed at the trot; both being hereditary qualities which have been strongly developed by artificial selection.

Also, the fact that standard-bred horses of the present day acquire ability to trot comparatively fast, at a much earlier age than American trotters of former times and horses of other breeds, is a proof that speed at the trot is to a large extent an instinct (mental gift), which is the faculty of performing special movements under appropriate stimuli, without instruction or previous experience. At two years old, Arion (p. 578) came within reasonable reach of The Abbot in 1891; but Goldsmith Maid had to wait till she was past eighteen, before she made her record of 2.14 in 1875. Up to the age of seven years, she was able to get only a little within 3 minutes. Mozart at seven years of age and Mendelssohn at twelve years, appear to have played the piano quite as well as many professional pianists do, after twenty years of assiduous practice. It is recorded that Landseer had a picture hung in the Royal Academy when he was thirteen years old, and there are drawings of his in the South Kensington Museum, which he did when he was only five. Even a genius in manual or pedal dexterity must have his muscles capable of responding with suitable speed and power, to the special stimuli given to them by his nervous system; and to attain excellence, he requires practice, which in his case is accompanied by far better results than in that of an ordinary individual. As speed at the gallop is the horse's natural means of preservation, it is far less dependent on special nervous adaptation than speed at the trot, or ability to jump obstacles such as those met with when hunting in Leicestershire or "between the flags." Under natural conditions, the jumping ability of horses in a wild state is rarely tested to any great extent. Hence, conformation plays a much larger part in speed at the gallop, than in speed at the trot or " cleverness " in jumping.

Although early speed in the trotter, is much more common than formerly, it is possessed only by a small percentage of trotting stock, and is very highly valued, because it has been found to be an unerring proof that the speedy youngster is a trotting genius. As the young

Photo by] [THOMAS KEMP, DORCHESTER, MASS.

Fig. 570.—Mr. J. Malcolm Forbes's dark brown trotter, Bingen (2.06¼) ; stands 15.3.

stock of Bingen (Fig. 570) show great capacity to trot fast, they fetch very high prices. Early speed in the thorough-bred is no reliable proof that he will be fast when he is mature, for his conformation, which is the basis of his speed, often changes with years.

As a rule, the best American trotters vary in height from 15 hands to 15.2. Taller trotters seldom prove to be good campaigners, and consequently American trainers like horses which English hunting men would consider small; because they find them more lasting than big ones. Mr. Foster tells me that size has very little to do with trotting speed, although it materially affects the market value of trotters; and that there are several horses in the 2.10 list, which are not much over 14 hands. For his own use, he prefers horses from 16 hands to 16.1, because such animals can pull a fair amount of weight, when their racing days are past. The following is a list of the respective heights of some of the most famous American trotters:—

	Hands	
Flora Temple (2.19¾)	14.2½	
Jay Eye See (2.10)	15	(under)
Alix (2.03¾)	15	
Goldsmith Maid (2.14)	15.0½	
Nancy Hanks (2.04)	15.0½	
Dexter (2.17¼)	15.0¾	
Directum (2.05¼)	15.1	(at 4 years old)
Maud S. (2.08¾)	15.2	(at withers)
	15.3½	(at croup)
Sunol (2.8¼)	16	(nearly)
Kremlin (2.07¾)	16	
Great Eastern (2.15¾)	17.1	

Lou Dillon is 5 years old, stands 15.1, weighs 804 lbs. and is a Hambletonian Star.

Mr. George H. Ketcham tells me that his famous ex-champion 9-year-old chestnut stallion, Cresceus, stands 16 hands ½ inch high, and weighs in "trotting order" 1,050 lbs.

The Mambrino Chiefs are tall and leggy; the Morgans keep close to 15 hands; and, as stated on page 572, the Hambletonians vary a good deal in height.

The sulky is an important factor in the conformation which is best suited for the trotter, because it increases the stability of the animal's equilibrium (p. 69) during movement; but with a rider, especially of the "crouching jockey" kind, the stability of the equilibrium is greatly diminished. Consequently, the best trotters are considerably shorter in the body, as compared to their height, than our best racehorses, a fact which we may see by comparing Cresceus (Fig. 566) with Ormonde (Frontispiece). Formerly, when the competing distance was from 2 to 4 miles, the relative length of the body of the trotter was greater than now; because, at present, the course does not usually exceed one mile. Also, the shoulders of the fast trotter are more upright and heavier than those of the racehorse, which kind of conformation adds to the weight in front.

An increase of about 4 seconds in the mile is supposed to have been effected by the "bike sulky"; and a similar improvement in speed is said to be obtained by the "wind-shield" and pace-makers.

In comparing the conformation of the trotter with that of the racehorse, we must bear in mind that, as a rule, the former is a good deal older than the latter, and consequently is "thicker set" in the body. Also, the trotter's work demands more endurance, because he has usually to win three out of five heats, generally of a mile each. We therefore find in the American trotter, a marked absence of the greyhound appearance (p. 232), which is a distinguishing feature of many of our thorough-breds (Figs. 9 and 318); in fact, the "standard-bred" generally resembles the steeplechaser (Fig. 432), in being round in the barrel and well ribbed-up. If Americans adopted one-heat races, the trotter would probably become as light and "tucked-up," as the ordinary thorough-bred. Against these remarks on staying conformation, my readers may point to the fact that the photograph of Lou Dillon shows that she is—as Mr. Foster terms her—somewhat "wasp-waisted." This peculiarity on her part does not affect the present question, because she gained her record in a single time trial. She was behind a pace-maker, which had a "dust-shield" of wire netting, but no "wind-shield"; and she did not compete against other horses. Mares, as a rule, are not so well ribbed-up as horses (pp. 235 and 236).

Mr. Foster tells me that the fore pasterns of the "standard-bred" are not so long as those of the thorough-bred. As the gallop is a pace of four time (p. 120), concussion on the fore legs is greater and the centre of gravity of the body descends lower during each stride, in it, than in the trot, which is a pace of two time (p. 102). Hence, long and sloping pasterns are much more needed by the thorough-bred than by the trotter, because this kind of conformation is of special advantage for diminishing the bad effects of concussion on the fore legs, and for raising the fore-hand.

As the heavier condition of the shoulders of the trotter is caused by the larger muscular development of the part, the distance between his fore-arms (p. 244) is greater than in the racer. As pointed out on page 69, any undue width between the fore legs would militate against speed in the galloper, because it would tend to keep his fore feet too far apart from each other; but this drawback is more or less obviated in the fast trotter, by the fore legs being inclined inwards, so that the fore feet come unusually close together, both when standing and moving. Mr. Foster tells me that it is a very common thing to see fast trotters standing with their fore hoofs touching; and that, in the case of young ones which are taken up and worked on the track, their fore feet come closer and closer together, as speed increases. Naturally, this peculiarity in the conformation of the trotter increases his liability to hit himself. The action of the hind feet of the trotter remains true, like those of the hunter and racehorse.

As the height to which the centre of gravity has to be raised at each stride, is less in the trot than in the gallop, a heavy fore-hand is not such a disadvantage to the trotter in this respect, as it is to the thorough-bred.

One of the best marked peculiarities of standard trotting breds is a tendency to "turn out their toes," which means that the respective directions of the pasterns and hoofs of the fore legs, instead of being parallel (from front to rear), incline more or less outwards (Fig. 57), and consequently form an angle with each other. This abnormal conformation is almost always due to the fact that the axis of the pastern bones is not in the same vertical plane as that of the cannon bone (Fig. 55). As the horse has hardly any "side play" (power of lateral rotation) in the joints of his fore legs, he is unable to rectify this abnormal position of the pastern bones during movement,

Photo by] [SCHREIBER & SONS, PHILADELPHIA.

Fig. 571.—American trotting stallion, Kremlin (2.07¾).

or when standing still. Turning out the toes is a serious defect from an ordinary working point of view, because it makes the affected animal more or less liable to "hit" himself ("interfere"); but it may be an advantage in the match trotter, because, with the gradual and continued increase of speed, it has become more and more a characteristic of this breed. Hambletonian, like almost all the other old-time trotters, did not turn out his toes; but, now, about nine-tenths of standard trotting breds "toe out." Kremlin (Fig. 571), who did a mile in $2.07\frac{3}{4}$, was a comparatively rare exception in his class, and did not wear knee boots; yet many of his stock copy Cresceus and other record breakers in the adoption of this attitude. Following the teaching of Darwin, Wallace, Weissmann, and other exponents of the laws of heredity, we must regard this pculiarity as the result of artificial selection, in breeding from the fastest trotters without regard to normally correct conformation. Here, variation is an all-important factor. On pages 295 to 297, I have tried to give a rough mathematical explanation of the advantage, from a record-breaking point of view, of turning out the toes in trotting.

The drawback of "hitting" is greatly obviated by the use of "boots"; in fact, "boots make the trotter" as Americans say. Almost all fast trotters have to wear several kinds of boots (Fig. 572) when doing their best; but at a slower speed, they do not require them as a rule. Many become so well aware of the danger of hitting, that they will not extend themselves, if their legs are not thus protected. "Grabbing boots" are used to protect the heels of the fore legs; "scalpers," the toes and coronets of the hind legs; "quarter boots," the coronets in cases of brushing; and "ankle boots," the fetlocks. "Knee and arm boots" are employed against speedy cutting; and "elbow boots," against the elbows being hit, in which case, the animal is liable to get one or both elbows "capped." Knee, arm, and elbow boots require "suspenders" to keep them in place.

Although the upright condition of the shoulders and comparatively short body of the match trotter are points of conformation which are favourable to speed at the trot, they have the serious disadvantage of rendering him peculiarly liable to strike his hind toes and coronets against his fore feet, which, when he is going at high speed, he is often unable to lift up with sufficient quickness, to prevent them being hit. In fact, the great difficulty which the fast trotter has to contend against, is that of getting his fore feet out of the way of his hind ones. Hence, progress in trotting speed is accompanied by increasing necessity for protection in the form of "boots," which is a mechanical factor that renders high-speed trotting an artificial gait. The close approximation of the feet of the trotter to the line of direction in which he is proceeding, greatly favours his speed, by diminishing the

Photo by] [BAKER ART GALLERY, COLUMBUS, OHIO.

Fig. 572.—Mr. George Ketcham's Cresceus (2.02¼) in Faber sulky.

tendency to lateral movement. In fact, when the trotter travels fast, the imprints of his fore and hind feet tend to come into a straight line. Although this arrangement of the feet favours speed, it increases the animal's liability to "hit himself," and adds to the value of boots.

It is evident that all kinds of conformation which increase the proportion of weight on the fore-hand, diminish the ability of the trotter to get his fore legs out of the way of the hind ones, at high speed. Consequently, the more the height at the croup exceeds that at the withers, the greater will be the tendency of the hind legs to interfere with the fore ones.

The faster the speed at any gait, the truer must be the action. Hence the knee action of the stars of the "Harness Turf" is not exaggerated. Mr. Foster tells me that horses with high action give the impression that they are travelling faster than they are actually doing; but that those which bend their knees only to an extent sufficient for the attainment of great speed, deceive us in the opposite way. Consequently, trotters and pacers which are competing near the 2.05 mark, often appear to be going slower than fields of the 2.30 class. Lou Dillon's action is low and "stealing." "High" action in no way diminishes the tendency to "interfere."

Since page 569 of this book went to "press," I see that Mr. John Gilmer Speed states, in *The Century Magazine*, September 1903, that the pedigree of the Charles Kent mare is "quite unknown," and that Bellfounder was not her sire.

Pacers.—Forty or fifty years ago, it was supposed that there was a typical pacing conformation; but now there is practically no difference in shape between trotters and pacers. Probably, three-quarters of the pacers are trotting bred. The Wilkes family furnished a large number of pacers, and consequently its young stock disappoints many of their owners. Advance of speed in the trotter has been accompanied by a corresponding increase in the number of trotting-bred pacers; because, as we have seen, the conformation most suitable to trotting speed, greatly increases the tendency to "interfere." As this tendency is present to a far less extent in pacing than in trotting, it follows that horses which are inclined to "hit" themselves, will prefer the former to the latter gait, especially as they are not allowed to canter or gallop. It is interesting to note that the shorter the comparative length of the body, the greater the tendency to pace. Also, as the pace entails less concussion on the fore legs than the trot, many fast trotters take to pacing, when they become unsound. For instance, Jay Eye See, after he had gained the record of 2.10 at the trot, made a record at the pace, when he became foot-sore. Some horses can show great speed at either the trot or pace, as may

Photo by] [" BOSTON JOURNAL."

Fig. 573.—Mr. White's Star Pointer (1.59¼); stands 15.2½ high.

be required of them, and thus they resemble certain athletes who can do very fast time either walking or running. Generally, a pacer rocks from side to side, and places his feet more nearly in a straight line than a trotter. Star Pointer (Fig. 573), who held the pacing record of 1.59¼, is pacing bred; but most of the other fast pacers, such as Joe Patchen and John R. Gentry (Fig. 574), are trotting bred. Dan Patch made a pacing record of 1.56¼, in 1903.

Owing to the higher value of a trotter, no owner tries to convert a fast trotter into a pacer, unless forced to do so; but the number of pacers has increased so much that they have had to be put into a separate class. Formerly, pacing was regarded as a disgrace to a trotting horse, and toe weights were used on the fore feet, with the object of making a horse extend these feet well to the front, so as to prevent over-reaching; but now they are seldom employed, on account of the increasing popularity of pacing.

Photo by] [SCHREIBER & SONS, PHILADELPHIA.

Fig. 574.—Pacing stallion, John R. Gentry (2.01½).

South American Horses.—The only South American horses of which I have had any practical experience were those of the Argentine Republic. Fig. 575 shows an Argentine mare, by an imported English thorough-bred, which was fast, a great stayer and clever jumper, and which carried my wife in good style, out hunting in Leicestershire and North Cheshire. Another Argentine mare which we had, won a couple of steeplechases in England. I have seen many serviceable Argentine horses in London at work in trams and cabs. In this country, Argentine horses acquired a bad name during the late Boer war, on account of incompetent selection and gross mismanagement, on the part of our army officials. Most of these remounts were landed in South Africa with their feet in a rotten state from standing in wet and dirt during the voyage, and

Photo by] [M. H. H.

Fig. 575.—Mrs. Hayes' Argentine Hunter, Polly (15.2).

they were then promptly sent to the front and put on a form of food which they had never before tasted. Everyone who has had experience with newly-imported horses that have been taken off grass, knows that they cannot become fit for hard work, without at least three months' careful preparation. Figs. 576 and 577 represent two fairly typical Argentine remounts whose photographs I took in South Africa in 1901.

Mr. Cecil Gosling, H.B.M.'s Consul for Paraguay, who has had a long and intimate acquaintance with South American horses, very kindly gives me the following notes on these animals :—

" Before fifty years ago, hardly any horses were imported from Europe to the Argentine Republic, and the native animals were renowned for their extraordinary ability to do long journeys on no other food than the

Photo by] [M. H. H

Fig. 576.—Argentine remount in South Africa.

natural grasses of the 'camps' (countries). Since that time, vast numbers of horses have been imported, and the Argentine promises to become one of the greatest horse-breeding countries in the world. Among other imported equine notabilities was Ormonde, who did not achieve any great success as a sire, for although he did not transmit his infirmity of roaring, his stock were of very little use for racing purposes.

" On account of these numerous importations, the old

Criollo (native) breed has almost died out, and has not been replaced by an equally good breed. The Criollo is found chiefly in Entre Rios, Corrientes and Paraguay. To European eyes, his appearance is not pleasing. The head is coarse and the eyes small and sunken. He has frequently a ewe neck and a long back. His tail is often badly set on, and he is frequently cow-hocked. The feet and legs are usually good, the shoulders are fairly well

Photo by] [M. H. H.

Fig. 577.—Argentine remount in South Africa.

sloped, and he is a safe conveyance, although inclined to trip at the walk. In spite of his ragged appearance, he somewhat resembles the Barb, from whom he probably sprang. Standing in the stable, or hitched on to a rail, he has a most disconsolate appearance, and a stranger, by merely looking at him, would never appreciate his value. But the moment he is mounted, he becomes full of fire, and will carry a heavy weight fifty or sixty miles a day, with ease, or will cover a hundred miles in a day, if necessary. The Criollo shown in Fig. 578 was stabled for several years, and consequently is not 'in the rough.'

"The pony class usually found in the Argentine is the *mestizo* (half-bred), which is the product of a native mare and a sire with some foreign blood in him. They are generally from 14 hands to 14.3 in height, and make good polo ponies, and are also very suitable for mounted infantry, if properly handled. They can be purchased in the country districts in the Argentine for about £5 apiece. The Argentine polo ponies which are now played in England, are good representatives of this breed. Much has been said in England about the slowness of the imported Argentine ponies, which statement can be explained by the fact that fast ponies have a considerable commercial value among the natives, for gambling purposes. Several racing ponies have been lately shipped from Buenos Ayres to South Africa, with, I believe, very good results.

"Excellent light saddle horses are bred in the Argentine, and are well suited to make hacks and officers' chargers. I have no doubt that good horses of the hunter class could be obtained in that country. Well-bred Argentine saddle horses are very similar in appearance to English horses of the same class, and can be bought from £15 to £25 in the rough, though broken. After importation into England, they require nearly a year's preparation before they can be put to hard work, and the use of maize, to which they are accustomed, should be gradually discontinued.* The Anglo-Argentine thorough-breds are of high class, and they run their races in Buenos Ayres in fast time. La Uruguaya, a Uruguayan mare, ran prominently in England. In South America, horses, when trained for flat racing, are generally given very short, repeated gallops. They are exceedingly quick off the mark, and as a rule are ridden by native jockeys who use a curb and not a snaffle. Argentine thorough-breds are gener-

* During the last two years, I have had excellent results in feeding hunters on equal quantities (by weight) of crushed maize and dry bran, instead of oats.

ally much more docile than English race-horses. Mr. Samson's Peppermint, which captured all the classic races in Buenos Ayres last year, and which was trained by Fraser, has gone to South Africa.

"All Argentine horses are fed on dried or green *alfalfa* (lucerne*), which grows exceedingly well in the Argentine, and is an admirable food for horses. As a rule, Argentine two-year-olds are bigger and better developed than English thorough-breds of the same age. They generally resemble

Fig. 578.—Mr. Cecil Gosling's Criollo horse.

North American horses, and are rather plain about the head.

"The *Bagual*, or semi-wild horse, is found in South Argentine and also in Paraguay. He is not unlike the Criollo, though still more degenerate. He is frequently light dun in colour, with a dorsal stripe (p. 330).

* The amount of lime contained in lucerne is five or six times greater than in ordinary meadow grass.

"*The Chilian pony* is usually a better looking animal than the Argentine, but he is lighter in build and bone, and his paces are not so good, which is probably due to the Chilian partiality for teaching ponies to 'dish' (turn out their feet laterally, while raising them off the ground). These animals make very good light-weight polo ponies.

"*Peruvian horses* are showy and handsome, and somewhat resemble the Andalusian horse. They are amblers from their birth, apparently from artificial selection, and are very pleasant to ride for long distances. The vendor of a Peruvian horse frequently asks the intending buyer to try the horse, while holding a glass full of water in the right hand. Not a drop will be spilt, if the animal is a smooth goer. These horses amble very fast.

"*The curly-coated pony* is a very old breed which is now nearly extinct. Its Indian name is *Pyshai*, which is pronounced Pee-shy-ee. It is lighter-bodied than the Criollo, and, like a retriever, has curly hair over the body and legs. These ponies differ from other breeds in hot countries, by having an unusually long coat. Their origin appears to be unknown."

CHAPTER XXXII.

ASIATIC AND NORTH AFRICAN HORSES.

Mongolian Ponies—Turkish Horses—Persian Horses—Arab Horses—North African Horses—East Indian Horses—Burma and Manipuri Ponies—Sumatra Ponies—Corean Ponies—Japanese Ponies.

WITH the exception of Turkish horses and Corean ponies, I have had more or less experience with all the animals in this list, during the many years I lived in the East. Fortunately, I was able to supplement my personal knowledge with much useful information, from experts who know a great deal more about certain classes than I do, and whose aid I have gratefully acknowledged in this chapter.

Mongolian Ponies (Figs. 281, 579, 580, and 581).—Under this broad heading, we might safely class the ponies which are found in high-lying countries between Siberia and the Himalayas, because there is no distinctive difference between the respective ponies of Bhootan, Nepal, Spiti, Yarkund, and Mongolia, for instance. The so-called China pony is bred in and sent from Mongolia (including Manchuria) to China, usually *viâ* Tientsin. They have thick-set bodies, short and strong legs, capital feet, fairly good shoulders for a saddle, and are hardy and sure-footed. They average about 13.1 in height, and are slow gallopers. In China, Mongolian ponies are used extensively for racing, of course, among themselves, and with excellent results, as far as sport is concerned; for the entries are large, Dr. J. F. McClean, who has been living some years in Turkey, tells me that " the most typical indigenous horses in Turkey are those which are bred on the plains near Sivas, and which are called Kurdistan ponies (Fig. 586). The mares are crossed with Arab stallions, and give us the ordinary horses that are used in Turkish towns. Nearly

Photo by] [SATOW, SHANGHAI.

Fig. 581.—Mr. Burkill's grey Mongolian gelding Loyalty, (13.2).

all the good carriage horses and army remounts come from Hungary. South Russia also supplies a small number of remounts. During the few years I have resided in this country, I have not seen a single specimen of the heavy type of horse. Outside of the towns, horses are hardly ever harnessed; oxen do the draught work, and camels do most of the pack work."

Persian Horses.*—Persia is admirably adapted for horse-breeding, on account of its favourable conditions of climate, soil and water. Although there is an immense number of horses in Persia, the inhabitants of that country take very little interest in their equine property, and are lamentably ignorant about everything that concerns the welfare of their animals. Well-to-do

Photo by] [W. A. DELLA GANA.

Fig. 582.—Baghdadi Arab (15 hands).

Persians regard their horses merely as a means of conveyance and "show," and as they think it beneath their dignity to enter a stable, they give a free hand to their Mir Akhor (Lord of the Manger), whose one object is to make all he can out of his position as stud groom. The bad stable management is equalled by carelessness in breeding, for which purpose, Persians

* Mr. W. A. Della Gana, F.R.C.V.S., Veterinary Adviser to H.I.M. The Shah of Persia, has most kindly supplied me with the following notes and photographs of Persian horses.

think any mare is good enough, if she is able to bear a foal. Hence the predominance of equine weeds in that country. The colts (which are very seldom castrated) and fillies are put to work as soon as they can carry a rider, and it is no uncommon sight to see a 10 or 12 stone man riding a yearling in a heavy native saddle. Although these animals are "ragged" in appearance, they are

Photo by] [W. A. DELLA GANA.

Fig. 583.—Mr. B. Messervey's bay Turkoman horse (15.3).

capable of doing much work on small rations of inferior food, which generally consists of barley, broken and bruised straw (*kah*; Arabic, *tibn*), and dried lucerne. During the Eastern process of threshing, the straw is converted into *tibn*, which is far better than chopped straw for making a horse masticate his grain-food properly.

"Though the Persian kings in the fifth century B.C. bred the largest and best horses in Asia, these were not of an Arab strain. These horses were kept largely in

Armenia, and are described by Strabo as similar to the Parthian horses, and as differing from the horses bred in Greece, and the other kinds of horses known in the Roman Empire" (*Ridgeway*).

In Persia there are many different breeds of horses and ponies, apparently on account of the difficulties of communication, and the conservative nature of the people,

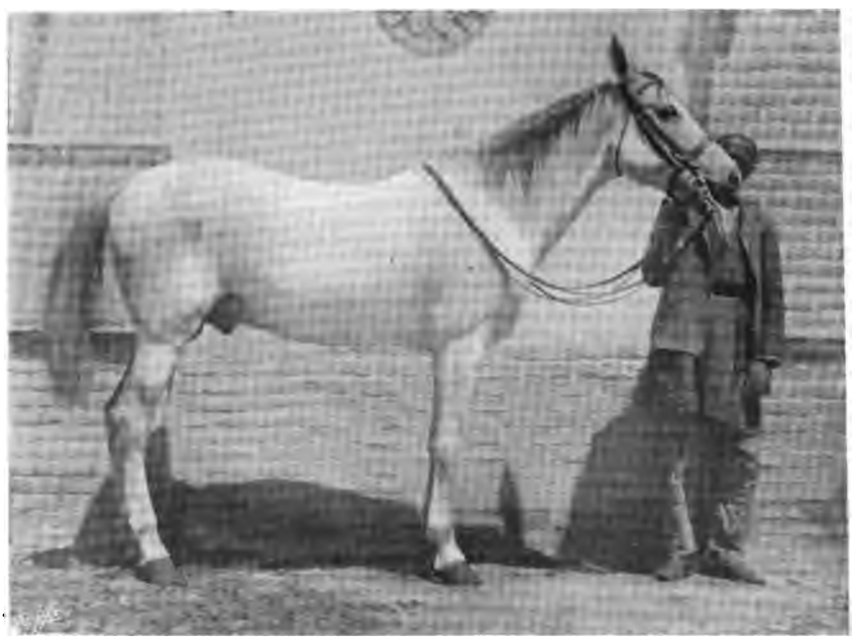

Photo by] [W. A. DELLA GANA.

Fig. 584.—Mr. Della Gana's Turkoman horse (15.1).

who like to conduct their breeding operations in their own separate districts, and apart from all outside influences. The following are the most distinctive breeds in Persia :—

The Persian Arab generally comes from Baghdad and the surrounding districts, varies from 14 to 15 hands in height, and as a rule is not of high caste. The prevailing colour is bay, although greys are frequently seen.

The Turkoman Horse (Figs. 583, 584, and 585), which is the largest and most renowned horse in Persia, comes only from the Persian province of Khorassan and the Russian province of Merv. They usually stand from 15 to 16 hands high, and are generally bays or greys, although blacks are sometimes met with. Turkomans are the typical horses of Central Asia, and they form no breed of ponies. A legend tells us that Bucephalus, the horse of Alexander

Photo by] [J. DELTON, PARIS.

Fig. 585.—Merv (Turkoman) horse.

the Great, was of this race. It appears that several attempts have been made to improve this breed, for we read that Tamerlane distributed five thousand Arab mares among the Turkomans; and Nasr-ed-Din, the late Shah of Persia, sent them five hundred Arab mares for the same purpose. Notwithstanding these innovations, the Turkoman horse of to-day shows little or no trace of Arab blood; in fact, he is more like an English thorough-bred than an Arab. He has a coarse head, large and intelligent eyes, long and thin neck (inclined to be "ewe-necked"), and moderately high withers. He is narrow in the chest, deep in the girth, and slack in the back ribs. His hind quarters are deficient in muscle, and his tail is carried low. His legs are long, thin, and light in bone below the knees and hocks. These horses cannot be surpassed on level,

Photo by] [W. A. DELLA GANA.
Fig. 586.—Mr. H. A. Richards's Kurdistan pony (13.2).

sandy soil, such as that of the Desert, where they can cover from 80 to 100 miles in a day, without showing much fatigue. Formerly, Turkoman warriors made their raids into Persia on these animals. In rough hilly country, these horses are almost useless, on account of their hoofs being weak and thin, which is their great failing. They are seldom if ever shod in the Desert, where their hoofs maintain a comparatively tough condition. They are usually docile, and, unlike other horses in Persia, they have good mouths. The fact of the Persians hogging the manes of these animals, and leaving their tails long, gives them a strange appearance (Fig. 585). Turkoman horses are rarely seen south of Ispahan, or in the Western Provinces. They are never ridden by fashionable Persians, probably on account of social prejudice.

We read in Delton's *La Photographie Hippique*,

Photo by] [W. A. DELLA GANA.

Fig. 587.—Mr. Charters' Shirazi horse (15.0).

November, 1892, that Merv horses (Fig. 585), which are Turkomans, often make the journey across the very hard desert, from Merv to Khiva (280 miles), in three days, while carrying a weight (including rider, saddle and equipment) of about 18 stone.

The Kurdistan Pony (Fig. 586), which is a native of the province of Kurdistan in Western Persia, is a hardy little animal that stands from 14 hands to 14.2, is usually of a grey or bay colour, and is capable of much exertion in a mountainous country. Although he is generally lacking in blood, as we may see by his coarse head and sickle hocks, there are many good specimens of this breed. They are short in the body, thick in the neck, have good bone, especially below the knees, are willing workers, and are well up to 14 stone. They are admirably suited as remounts for mounted infantry or irregular cavalry,

Photo by] [M. H. H.

Fig. 588.—Shirazi horse (Gulf Arab).

and make good polo ponies, for which purpose they are often used by the members of the Teheran Polo Club. Unfortunately, many of them have very hard mouths, which fact is due to the abuse of the Persian bit, and to want of training. This is the most numerous of all the distinct breeds of horses in Northern Persia.

The Shirazi Horse (Figs. 587 and 588), which is known in India as the "Gulf Arab," is the offspring of Persian country-bred mares and Baghdadi Arab stallions. They are bred in large numbers in the Central and Southern Provinces of Persia, chiefly for export. They usually stand from 14 to 15 hands high, and are generally grey, although bays are sometimes seen, and they gallop and walk well. They show many points of the Arab, principally about the head, and in the way they carry their tail, "like a flag," as Persians and Anglo-Indians say. They have good bone, but are often sickle-hocked. Their hoofs

Photo by] [W. A. DELLA GANA.

Fig. 589.—Karadagh horse (14.2).

are large and very tough. The great majority of them are docile, and hardness of mouth is their only common vice.

There are very few Arab mares in Persia, and in that country are owned only by rich Persians, who have to give from £150 to £200 a-piece for them.

The Karadagh (Fig. 589) is a breed of horses which originally came from the southern slopes of the Caucasus, and are the native horses and ponies of Armenia. It is probable that some of them have been recently crossed with Russian blood. They stand from 14 to 15 hands high, and their usual colour is bay, or chestnut with black mane and tail. They all have a black line (dorsal stripe, p. 330), which is about an inch broad and which extends from the termination of the mane, along the spine to the tail. They have good shoulders, intelligent head, broad breast, heavy body, strong

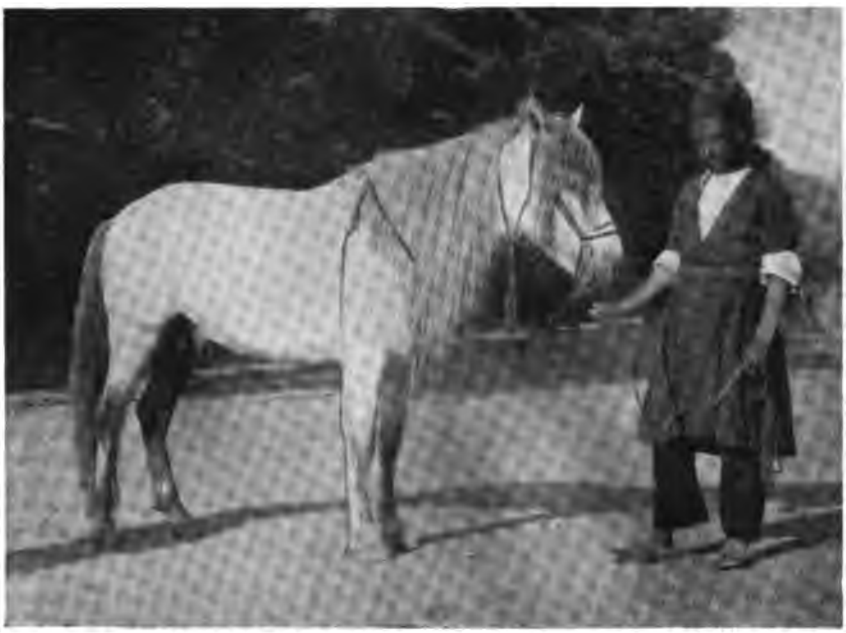

Photo by] [W. A. DELLA GANA.

Fig. 590.—Bokhara pony (13.1).

hind quarters, are well ribbed-up, and have plenty of bone below the knees and hocks. They are, *par excellence*, the harness horses of Persia, for they can put a great amount of weight into the collar. They are the favourite carriage horses of wealthy Persians; are used in pairs as cab horses in Teheran; and do most of the transport-waggon work, each waggon having a team of four horses abreast. They are very seldom ridden. In harness, they are good at a walk or slow jog trot, which, in a transport-waggon, they can keep up and cover 50 miles in a day, with a load of 3 tons behind them, even when the roads are of a very indifferent nature. Going down hill, they will break into a sharp gallop, with the springless waggon rattling behind them. They are docile and handy, and can do long journeys on little more than bruised straw and lucerne.

Photo by] [A. SCHINDLER.

Fig. 591.—A Yamoote (15.1)

The Bokhara Pony or Tattoo (Fig. 590) is a breed that comes from the Samarkand district of Turkestan. These sturdy animals are about 13 to 13.2 high, and are generally either white or grey, although bays and dark roans are sometimes seen. They are chiefly used as water carriers on journeys. Their principal characteristic is the large amount of woolly hair on their bodies. They have profuse manes and tails, and long curly hair on their legs. Their bodies are compact and short, and their heads large and coarse. They have short necks, deep chests, good bone below knees and hocks, are up to great weight, and are very sure-footed. Their best gait is a kind of amble, which they can keep up for hours, without fatigue. They are usually somewhat sulky, and do not readily respond to spur or rein. The word *tattoo* (pony) is derived from Hindi, and is applied to all kinds of ponies in Persia, as well as in India.

Photo by] [W. A. DELLA GANA.

Fig. 592.—Persian Yaboo in native cart (14 hands).

The Yamoote (Fig. 591) is a cross between a Turkoman mare and a Baghdadi Arab. They are nice-looking animals, which stand from 14.2 to 15.1, and are a happy combination of the respective points of their sires and dams. They are generally grey in colour, though duns are occasionally seen, and they have usually black points. They are heavy in the body, have good shoulders, but low withers. The head is fine and well carried; the neck is long and is sometimes inclined to be concave (ewe-necked); and the legs are well-shaped, but often wanting in bone. They appear to inherit the failing of having weak feet. Their paces, especially the walk and trot, are good and comfortable to the rider. Their temper is uncertain, but little difficulty is experienced with them after they have become accustomed to an experienced rider.

Yaboo (pony or hack, Fig. 592) is the term applied to nondescript animals of no definite breed. These small equine weeds are not to be despised, for they are very useful as pack animals, and are capable of carrying comparatively heavy loads on long journeys over mountain passes. Every mule caravan has a *yaboo* to lead it, and no muleteer would do his work without one. Wherever the *yaboo* goes, the mules follow him implicitly, and thus the caravan is kept together.

Russian Horses, including many Orlov trotters, are employed to a large extent in Teheran, for drawing the carriages of the wealthy. They generally reach Persia by the Caspian ports, but are occasionally brought by dealers to Teheran, *viâ* the Caucasus and Tabriz. For a description of these animals, see pages 539 to 559.

Arab Horses (Figs. 593, 594, 595, 596, 597 and 598).—As Arabia is about 1,600 miles long, and 700 miles broad, differences of climate and soil have produced several varieties of horses in it. General Tweedie, who was for many years H.B.M.'s Consul-General at Baghdad, tells us in his valuable book on *The Arabian Horse*, that "the typical Arabian is the horse of the Bedouin nations of Najd," which is a dry and high-lying district to the east of Medina. When the word "typical" is used with reference to breeds or varieties of horses, it is intended, as in this case, to convey the meaning of "characteristic and best." Another important breeding district is the Syrian Desert (Shamiya), which produces the Aeniza

Arab. Burckhardt (*Notes on the Bedouins and Wahabys*) states that horses do not thrive in Yemen, which is a country to the north of Aden. A considerable proportion of the horses which are imported (chiefly to India) under the title of Arabs, come from the districts adjoining the Euphrates and Tigris (Al Jazira, Irak, etc.); but few of these Turkish Arabians can claim to be Sons of the Desert, owing to the large admixture of foreign (principally Turkish and Persian)

Photo by] [J. COWELL, SIMLA.

Fig. 593.—The Maharajah of Patiala's Arab pony, Blitz (13.1).

blood, none of which, General Tweedie tells us, comes from England.

According to General Tweedie and Major Upton, no wild horses are found in Arabia. "In the Old Testament, the Arabs are never mentioned as riding anything but camels and asses. Though the author of Job knew of the war horse, Job did not own a single horse, his equine possessions consisting of 500 she asses. Herodotus (VII.

87) enumerates the nations (including the Libyans) that supplied cavalry to Xerxes' host, but the Arabs furnished only a camel corps. Agatharchides (cited by Strabo) describes the Arabs as camel keepers" (*Ridgeway*). There is no foundation for the tradition that Solomon sent horses to Arabia, and that the pure-bred Arab is descended from mares which belonged to Muhammad. It appears that horse breeding did not become common in Arabia until after the time of Muhammad (571–632 A.D.). Tweedie agrees with Burckhardt (1784–1817) that Arabia is not very rich in horses, owing to the narrowly limited extent of the pasture grounds in that country. It appears most probable that the Arab horse originally came from Mongolia.

We learn from General Tweedie that although the Arabs pay great attention to preserving purity of blood in their horses, they have no written pedigrees of their animals, because they are illiterate. They apply the general term, *Kuhailan*, to their pure-bred horses in a manner somewhat similar to our use of the word, "thorough-bred." We read in *The Arabian Horse*, that the parent trunk of *Kuhailan*, has produced four great branches (Saklavi, U'Baiyan, Hamdani, and Hadban); and that they, and it, are known in Arabic as Al Kamsa (The Five). In India (among the Muhammadans) and Persia, the Arabic word, *asil* (well-born, genuine), is often applied to a pure-bred Arab (Kuhailan). The word *kadish* (common-bred) "is so current among Arabs that Niebuhr, and after him other writers, make Kochlani (*Kuhailan*) and Kadeschi (*kadish*) their two leading sub-divisions of the Arabian breed. If we understand by the two terms no more than *asil* and less than *asil*, respectively, we shall have a useful enough rough classification. But Kadeschi must not be mistaken for a strain name. The *kadish* is merely the pariah of horse-flesh" (*Tweedie*).

Palgrave (*Encyclopædia Britannica*) tries to make out that pure-bred Najdi horses are not exported. Tweedie shows that this idea is entirely wrong, and that a large trade is done with India *viâ* Kuwait (Grane). As the Najdi Arabs ride only mares, they are naturally glad to get rid of their surplus entires at a remunerative price. Although they have a strong prejudice against selling mares for export, liberal payment enables them to occasionally overcome that feeling. Experienced Arab dealers whose friendship I have enjoyed, have often assured me

Photo by] [DIXON & SONS.
Fig. 594.—Mr. W. H. Walker's Arab horse, Magic (14.1).

that many of the best and highest caste horses bred in the Desert, are to be found among the Arabs sent to India for racing. Also, poor Colonel Valentine Baker, whom I had the great pleasure of knowing in Cairo, and who had an intimate acquaintance with Eastern horses, told me that the best Arabs were sent to Bombay, where I have often seen new importations of high character, fetch from £200 to £300 a-piece. The Arab horses I saw in Egypt, including those belonging to the large stud of that great lover of horses, Ali Pasha Shereef, convinced me that very few good Arabs go to Egypt, where, at that time, the average price was about £22. "We do not know of an easier method by which a European might see and buy Najdi horses prior to export than by stationing himself from June to September in the well-oasis of Barjasia, a three days' journey out of Kuwait. He would then be on the caravan route which leads from Najd to the sea coast" (*Tweedie*). The port of Kuwait is about 150 miles south of Bussorah.

Palgrave (*Narrative of a Year's Journey Through Central and Eastern Arabia*), Skene (*Sporting Review*, March, 1864) and others have insisted that there is "blood and stride in the desert which has never been seen out of it" (*Skene*). "Not only do all the facts refute the argument that Arabia contains better colts than those which she distributes, but they go further. They show that every desert of which we have any knowledge is so extensively stripped of its best blood-horses, that not many likely colts of from three to five years old remain in the hands of their breeders. If England possesses too many stud-horses, Arabia retains too few. One may visit a considerable encampment of the Aeniza and see no unweaned colts, except a few reserved ones, and those which the dealers will not buy. The stock which these people always have with them chiefly consists of well-tried mares, aged stallions, and the rising fillies" (*Tweedie*).

My friend, the late Esa bin Curtas, who was a large importer of Arab horses into Bombay, always maintained that the best Arabs did not, as a rule, exceed 14.1½ to 14.2 in height. From an all-round point of view, this opinion is undoubtedly correct, especially with regard to the true Sons of the Desert, the Najdi Arabians. Another Arab friend of mine, Ali bin Abdullah, who owned, trained and rode in India many Arabs to victory, likes them bigger, but in this, he is probably influenced by his keen love for racing. Although many Arabs which have been imported into India have been 15 hands, I would put the limit at 15.1 ; because I feel certain that the vast majority of so-called Arabs which are over that height, have foreign blood in their arteries and veins. In saying this, I of course allude only to horses which have been bred in Arabia. Judging by the Indian racing records of the past sixty years, the balance of galloping excellence is a little in

Photo by] [J. RUSSELL & SONS.

Fig. 595.—Maharajah of Jodhpur on Arab polo pony.

favour of big Arabs (those over 14.3), like Child of the Islands, Raby, Lucifer, Marquis, Sherwood, Euphrates, and Euclid. Yet, during the respective times when Anarchy, Chieftain, Shere Ali, and Turkish Flag raced in India, there were no faster Arabs than those brilliant fourteen-handers. Consequently, as far as speed for general purposes is concerned, I see no advantage in an Arab being over

14.1. The more an Arab exceeds, say, 14.2 in height, the more inclined is he to be long in the legs, light in the loins, and flat-sided. We may infer from the foregoing remarks, that the typical Arab is, according to our Western acceptation of the term, a pony.

Although Arabs are greatly used for racing purposes on the Bombay side of India, the events in which they compete, are almost always restricted to their particular class or to ponies of 14 hands and under; because, even with the liberal allowances they receive from all other classes, they have no chance against foreign rivals. In fact, they are neither race-horses nor racing ponies. The English fourteen-hand mare, Skittles, which belonged to Captain Mowbray of the Black Watch, beat in a two-mile match at Cairo, in 1886-7, the Arab Haddeed in a common canter, when giving him 7lbs. Haddeed was looked upon in Egypt as an extremely fast Arab. Mr. Kelly Maitland's 13.2 mare, Fleur de Lys, several times proved herself as fast as any Arab in India for three-quarters of a mile. Taking the time test, which has been applied with great precision to the running of Arabs, we find that their performances in India have been much inferior to those accomplished by the English ponies, Lord Clyde (formerly the property of Mr. John Watson), Predominant (Fig. 278), and Labby, and by the Australian mare Achievement, none of whom exceeded 14 hands in height. Even at polo in England, Arabs have to take a back seat, especially as the polo height has been raised to 14.2, which is a height that allows English polo ponies to have a large infusion of thorough-bred blood. Arabs are inferior to high-class English polo ponies, not only in speed, but also in cleverness. In India, a few Arabs have distinguished themselves at steeple-chasing, in their own class and against "country-breds," but Arabs as a rule, are not nearly such clever jumpers as ponies which have a strong admixture of English blood in them.

Despite the fact that Arabs do not shine as racers, chasers, hunters and polo ponies, they are of great value as light cavalry horses, for which special purpose they have been bred for many hundreds of years. In this respect, their courage, docility, great power of enduring long-continued fatigue, and ability to subsist on rough herbage, are qualities of pre-eminent importance. General Tweedie, writing in 1894, tells us that "fifty-three years ago, Captain Horne of the Horse Artillery undertook to ride his grey

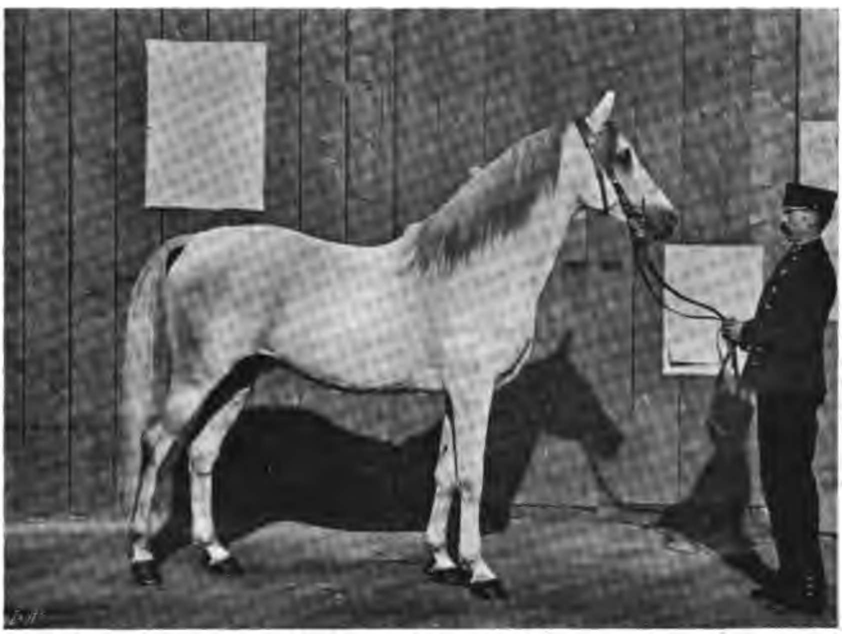

Photo by] [J. DELTON, PARIS

Fig. 596.—Arab horse.

Arab horse, Jumping Jimmy, 400 miles in 5 days, and accomplished the feat on the Bangalore race-course, before crowds of spectators, with 3 hours and 5 minutes in hand. Detailed accounts of this performance may be read in the *Bengal Sporting Magazine* of 1840. The feature which distinguishes it from the recent trials of equine endurance in Germany is, that Jumping Jimmy showed no signs of distress either during or after his exertions. At the end of the final lap of 79 miles, 5 furlongs and 30 yards, which was done in 19 hours and 55 minutes, the gallant grey was as ready as ever for his corn." The Arab is a delightful hack, as he is singularly free from timidity, impetuosity, fidgetiness, jibbing, and other vices which make riding and driving a distasteful labour. The admirable mental qualities which adorn the Son of the Desert, are evidently the outcome of the careful selection which his breeders have practised for many ages on their equine companions.

The principal colours of the true Arab are bay, brown, chestnut, nutmeg grey and flea-bitten grey. I am inclined to think that more flea-bitten grey Arabs were imported into India during the early sixties, when I first had the pleasure of making the acquaintance of Arabian horses, than at present. Among pure bred Arabs, black is a very rare colour, and dun is practically unknown. A dark mane and tail in a chestnut Arab, is an undoubted sign of blood. I believe that a light mane and tail is seldom if ever seen in a Kuhailan. A perusal of Indian racing records will show that a large majority of Arabs are bay, brown, and chestnut. The idea that grey is the characteristic Arab colour (p. 326), is a wide-spread fallacy, especially on the Continent.

The term "Gulf Arab" is applied in India to Shirazi horses (p. 609) which have been imported as Arabs.

The most characteristic physical point about the true Arab is the peculiar and beautiful way he carries his tail, which, when walking, he always (as far as I have seen) holds to one particular side (either to the off or near) and well elevated, as in Fig. 593, and he does not, like the English thorough-bred, swing it from side to side, while walking. Many Arabs, when galloping, hold the dock (the solid portion of the tail) in a more or less vertical position. The Arab's tail is set-on very high, and its muscles are particularly well developed. The hair of the mane and tail is never coarse. He has a handsome and intelligent head, with broad forehead, large "kind" eyes, straight or concave line of face, large nostrils, well carried ears, lean and wide jaw. His neck may look somewhat coarse to persons who are accustomed to ride only geldings and mares ; but in reality it is comparatively light for a stallion. The head is well set-on to the neck, and is carried bravely. His shoulders are well sloped, although they and his withers often err, from a galloping and jumping point of view, on the side of thickness, which is due to the large size of the muscles that enable his

Photo by] [M. H. H.

Fig. 597.—Mr. Dignum's Arab pony, Magistrate.

fore-hand to bear weight. The common statement, that Arabs have bad shoulders, has evidently been made by persons who do not know that the kind of shoulders which might be very good in one class of riding horse, might be equally bad in another variety of saddle animal. He has capital fore legs, and his strong and sloping pasterns (Fig. 356) are particularly well adapted for fast work on hard ground. His loins are flat, broad and powerful. For roundness of barrel and length of back ribs, for levelness of croup, and for beautiful carriage of the tail, he is without equal among horses. He is not unfrequently higher over the croup than at the withers. The large development of the muscles of his fore-hand and loins makes him a good weight-carrier for his size. The grandly shaped barrel of the Arab plainly indicates that he has clear wind, strong constitution, and is a good "doer." His hocks, like those of Russian remounts (p. 555), are his weak points, apparently because his breeders have not had a Jorrocks among their prophets to tell them that, "no 'ocks, no 'unter." The only common fault in the hocks of Arabs is that these joints are somewhat deficient of bone, and are consequently not very strong. Arabs are seldom sickle-hocked or cow-hocked. We often meet Arabs which are a bit "back at the knees" (calf-kneed), but I have never found this fault of conformation injuriously affect the soundness of an Arab. Ali bin Abdullah used to argue that the fact of a horse being calf-kneed, increased his speed, because it enabled him to add a few inches to each stride.

Fig. 593 shows us Blitz, who was the best 13.1 Arab pony that has ever ran in India, but he was not as fast as the English pony Mike (Fig. 279), who was about half an inch the smaller of the two. Blitz is one of the most typical high-caste Arabs I have ever seen. Magic (Fig. 594), whom I sold to his present owner, won for me some races among his own class in India. His name is now in *The General Stud Book*. Magistrate (Fig. 597) won many pony races in India, and was subsequently exported to Australia as a sire.

Thick (bushy) hair in the tail in an Arab (Fig. 598) is a well recognised indication of low caste, although the under-bred possessor may be strong and useful.

North African Horses. — These animals are confined chiefly to Abyssinia, Nubia (Dongola), Egypt, Tripoli, Algeria and Morocco. They appear for the first time on the monuments of Egypt in the eighteenth century B.C., and about 1000 B.C., "Solomon had horses brought out of Egypt" (I. Kings, x. 28). We learn from the study of equine evolution (p. 692), that horses came from America into Asia, and from Asia into Europe. North Africa most probably obtained them from Europe (p. 679). A migration of horses from Arabia into Eastern Africa may have been effected across

Photo by] [M. H. H.

Fig. 598.—Low-caste Arab pony.

the Isthmus of Suez, and, to a much larger extent, over land which subsequently became submerged and is now occupied by the Red Sea. General Tweedie supports this theory on page 99 of *The Arabian Horse*. Also, we have the fact that Egypt is a poor horse-breeding country, but the districts to the south and east are admirably suited for that purpose. "The Libyans from the dawn of history are m2sters of the most famous horses. Cyrene sent the best horses to the games of Greece (Pinder, Pyth. IV.

etc.). It is noteworthy that it was in the same century as the founding of Cyrene, that the four-horse chariot and the race-horse were added to the Olympic events. The Phœnician settlers at Carthage found the Lybians using these beautiful horses, and when they struck coins they placed a horse or a horse head on them as the badge of Lybia, and used a similar type on their coins struck in Sicily, whither doubtless they carried the Lybian breed. This accounts for the extraordinary fame of the horses of Etna and Syracuse, and the famous steeds of Tarentum" (*Ridgeway*).

The North African horse is usually two or three inches taller than the Arab. He has generally a coarse head, light body, long legs, drooping pelvis, thick and bushy tail, good temper, and high courage. Though his conformation is defective from a riding and driving point of view, he stands work on hard ground very well, and is hardy.

The most typical North African horses are probably found in the district of Dongola. Those of Abyssinia and Egypt are of inferior class. The term, Barb, is applied to the horses of Morocco, Algiers and Tripoli, which, in former times, have been largely crossed with imported Syrian Arabs.

Judging by the many Barbs I saw in Gibraltar, Egypt, and Malta, and by the information I received about that breed from experts, I am strongly of opinion that they are much inferior to Arabs, as gallopers, weight-carriers, and stayers. For a mile race on the flat, an average Arab would give an ordinary Barb of the same height, about three stone and a beating. Many of the Barbs we see in Egypt, are regarded as Arabs. Captain E. D. Miller tells us in *Modern Polo* that: "My experience of ponies of this breed, both personally and with those belonging to other people, is that they are a good deal inferior to either Arabs or Syrians. Out of all the Barbs I have played and seen played in 1894-95, amounting probably to about seventy, Mr. John Walker's Sherry, M. Boussod's Trappist, Lord Charles Bentinck's Algiers and Tangiers, and Captain Barclay's Abdullah are the only five which could be called first-class."

Mr. Della Gana, F.R.C.V.S., who lived in Morocco for three years, tells me that "Morocco Barbs (Fig. 599) are exceptionally hardy, enduring and useful animals; and

Photo by] [J. DELTON, PARIS.

Fig. 599.—Morocco Barb stallion, presented to the President of the French Republic by the Sultan of Morocco (15.1).

this breed is officially preserved by the reigning Sultan. Before any horse can be exported from Morocco, a special permit must be obtained from the government, and in it must be stated a description of the horse, name of the owner, and place of destination. As few horses are imported into Morocco, the purity of the breed is well maintained. I once rode a Morocco Barb entire 50 miles in 12 hours, including a mid-day rest; and the Moors often try the staying powers of their animals much more highly than this."

"Barbs were formerly used as French cavalry horses and subsequently as chargers for French infantry officers. Their employment in the French Army is now restricted chiefly to Algeria and a few other colonies" (*Cagny and Gobert*). Algerian Barbs have been much crossed with French and English blood, and consequently have lost a good deal of their original type (Fig. 600).

For remarks on the classification of North African horses, see page 422.

East Indian Horses.—The native horses of India are of the smart, wiry sort (Figs. 417, 601 and 602). As a rule, they are best when they do not exceed 14.1 or 14.2; for the more they are beyond this height, the "weedier" do they become. Having light fore-hands and well-sloped shoulders, they are clever and jump well, and they have excellent feet. Their legs, though capable of standing a great deal of work on hard ground, are often mis-shapen, from errors of breeding and bringing-up; so that turned-out toes, calf-knees, cow-hocks, and sickle-hocks are of frequent occurrence among them. Generally, they are flat-sided and wanting in muscle over the loins. Consequently, they are poor weight-carriers, and bad stayers at fast paces; but are marvellously good at enduring fatigue and privation. The best of them make capital light cavalry horses up to, say, 13 st. 7 lbs. Although they are not as strong or as good-looking as Arabs, they are probably hardier and better suited to endure hunger and thirst. Many of them, especially if they have a dash of English or Arab blood, have a fair turn of speed, and consequently make good pig-stickers and polo ponies. Indian racing ponies which have a strong infusion of English blood, are generally about 14 lbs. worse than Arabs of the same height, and particularly so over long distances. At

14 hands it would be difficult to " bring them together " with English ponies in a race for, say, a mile. Without the constant importation of fresh blood from England, it is impossible in India to breed horses fit for racing, or for the requirements of English cavalry and artillery ; even then, the results are very poor (Fig. 442). Good as Tangri, Minden (Fig. 406), Engadine, and others of General " Ben " Parrott's breeding have been in their

Photo by] [J. DELTON, PARIS.

Fig. 600.—Bay Algerian Barb stallion (15.1).

own class and against Arabs, their form has been but little better than that of 14-hand English ponies.

Minden (Fig. 406) was a famous " country-bred " race-horse in India, among his own class, which is not within " measurable distance " of that of English £50 selling platers. Viewed as a smart saddle-nag, Minden looks a nice-shaped horse. He has capital shoulders and a good " middle-piece," as we may see by his photograph, which was taken when he was in training. The fact of his being longer in the body than he is high at the withers or at the croup, points to deficiency of speed.

Fig. 601 shows us a typical Kathiawar mare. She is a "three-cornered" animal; but, having been brought up among rough surroundings, is capable of enduring much privation and hard work, though necessarily slow, on account of her body being much longer than

Photo by] [M. H. H.

Fig. 601.—Kathiawar mare (14.3).

she is high at withers or croup. Her body is also very long compared to its depth. She is "calf-kneed," "sickle-hocked," and slightly tied-in below the hocks. As compensations, her shoulders are fairly well shaped; her fore-arms and gaskins are strong; and her "bone" below the knees is good.

Under the present heading we may put Cabuli (Fig. 903), Baluchi, and other Trans-Indus horses, which are largely used in India, and which, though stouter and shorter on the leg, are neither as smart nor as hardy in hot climates as the "country-bred." We might consider them as intermediate between the East Indian horse and the Mongolian pony.

Burma and Manipuri Ponies.—The so-called Burma pony (Fig. 604) is chiefly bred in the Shan Hills. He rarely exceeds 13.2, and is probably at his

Photo by] [M. H. H.

Fig. 602.—Indian country-bred pony (13.3).

best when about 13 hands high. He is a great weight carrier, jumps well, and is very hardy, though slow. The ponies of Manipur, which has been the home of polo for many centuries, are closely akin to those of the Shan States; but are smaller, and smarter for their size. When I was stationed in Cachar in the seventies, only Manipuri ponies were used for polo by the officers and planters in Assam. These two kinds of ponies appear to belong to a distinct breed, which seems to have no relationship with ponies of any other country except, possibly, with those of Sumatra and Java. The Burma pony is sometimes called a Pegu pony. In the vast extent of country from Rangoon to Mandalay, there are no good native ponies bred.

The body of the Burma pony has great depth in comparison to its length. For a saddle-pony, he has a

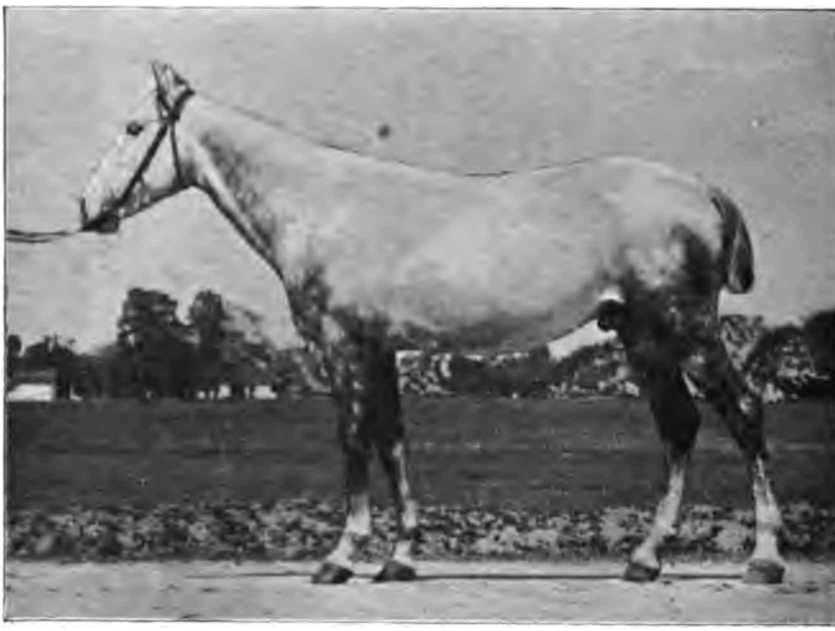

Fig. 603.—Cabuli gelding (14.2).

nice head and neck, and fair shoulders; but his croup is too drooping. He is much better "topped" than he is below his elbows and stifles. His fore-arms and gaskins are poor, and he has sickle hocks. As might be expected, Burma ponies, of which this one is rather a good specimen, are strong for their height, but slow.

Sumatra Ponies (Figs. 439 and 605).—While staying at Singapore in 1888, I saw a good deal of the *Battak ponies* which were used for cab work in that town, where they are called Deli ponies; Deli being the town in Sumatra from which they are usually exported to the Malay peninsula. They have handsome heads, set on to high-crested necks, are full of spirit, and are simply balls of muscle. The capable and light-hearted way in which one of these grand Liliputs can trot away with a four-wheeled vehicle containing five or six heavy men, is a

Fig. 604.—Burma pony gelding.

sight worth going many miles to see. Achen, which is in the north of Sumatra, has a good breed of ponies.

In Sumatra, which is their native home, they are largely employed for racing in their own class, in the same way as Mongolian ponies are raced in China. Battak ponies have almost entirely lost their original type, from frequent crossing with imported Arabs. Mr. Fitzwilliams, of Tandjong Poera, Sumatra, who has had great experience among these ponies during the seven years he has lived in that island, very kindly sends me the following notes on these tiny animals. "The majority of Battak ponies are of a brown colour, but many are skewbald, and the average height of the ponies which work in two-wheeled carts on the roads, is about 11.3. The best ponies measure from 12.1 to 12.2. I have had only two of the latter height, one of which, a chestnut roan, is probably the fastest racing pony in Sumatra. The Battaks are very fiery, and I have known several instances of these ponies running in carts until they dropped dead. Their mouths get terribly spoiled by the natives, and the skin and mucous membrane of the lips become fearfully hard and crinkled. It is a mistake to think that they are hardy. They are very plucky, and however poor in condition they may be, they always come out of their stables with a dash and a bolt, which soon evaporates. Under hard work, they quickly lose condition, and take a long time to pick up. They are not often vicious, although they are a bit ready with their teeth, like other entires. They are never castrated in Sumatra, but those which are exported to Singapore and the Straits, are generally 'added to the list' on arrival. The natives say that Battak geldings are of no use. Those I have seen, moved like mice and never carried their tails up. Battak ponies are easy to break in, but many are bad starters, on account of being driven with twisted wire bits and curbs. For their size, they are unsurpassable for cleverness over a bad country. Crossing on a single plank over a creek is nothing to them, and they are in no way daunted by having to walk on two betelnut trees which are cut down and laid across waterways, and which fit together so badly, that they spring up the moment the pony lifts a foot. Without any pressing, these ponies will jump from a high bank into a river and swim across it. The plucky and clever way they make for any accessible place, in order to get out, is wonderful. They have, naturally, very thick coats, which get finer after a few years' residence in the plains. With a little care in tying up, their tails will generally grow to the ground, and their manes are too thick to lie down. I have never seen a case of thrush in these ponies ; because the natives, however poor the roof of the stable may be, always put their ponies on a few planks which rest on round sills They always date any illness to the last time the pony slept on the ground. Battak ponies are so showy and neat, that they look like miniature chess-board horses.

Fig. 605.—Battak pony, Mohr.

" *Gayoe ponies* come from the hills which stretch from the Battak mountains to the north end of Sumatra, and are much more sturdy in build than Battak ponies. They have heavy crests and good shoulders, similar to the latter breed, but their legs are shorter and thicker, and they are stronger behind. They are not nearly so fast or so fiery as the Battaks." I believe they have not been crossed nearly so much with foreign blood as the Battak ponies.

I have also been favoured with most interesting notes on Battak ponies, by Mr. Carl Maschmeyer, who is a tobacco planter in Deli, where he has lived for a long time. He tells me that "sixty years ago, when the Achenese made their money by pepper gardens and did not spend it exclusively on guns and ammunition, the Achenese sultans and princes kept high-caste Arabs, and supplied the Battaks with Arab blood for improving their rather neglected breed of ponies; the result being a blend which combines in almost perfect harmony, the fire and the beauty of the Son of the Desert, with the hardiness and the endurance of the Battak pony. The Battaks live on high mountains which are not far from the frontiers of Achen, and have always been on good terms with the Achenese, who are interested in obtaining sulphur from the volcanic soil of the Battak plateau, in order to make gunpowder. Of late years, Battak ponies have come into extensive use in saddle and harness for officials, planters and Malay princes, and are also largely employed for cart work in the tobacco districts.

"The original colour of Battak ponies is said to have been mouse-grey, with a black stripe down the back (p. 330). Skewbalds and piebalds are in the majority, although all other colours are met with, except creams and greys. Pure white ponies with red eyes (albinos) and without any marks, remain the property of the chief of the district, and cannot be obtained by purchase. Battak ponies are generally docile in drawing carts, but when they jib, it is very difficult to get them to go on. As their weight is light, it is not judicious to make them draw too heavy loads. They have great agility in climbing, at which they have constant practice in their youth. Day after day, when going to drink, they have to climb down steep and deep ravines which traverse the plateau, and near which most of the Battak villages are situated, so as to have water at hand. The surprisingly good qualities of Battak ponies are naturally the outcome of the conditions of their native country, which consists of grassy plains and high mountains. As the Battaks are constantly in pecuniary difficulties, in consequence of their love of gambling and opium, they generally sell the colts, when these animals are from two to two and a half years of age. Those which fall into the hands of drivers of carts for hire, are usually of an inferior class, and therefore cheap. They are put immediately to work, and as a rule become ruined

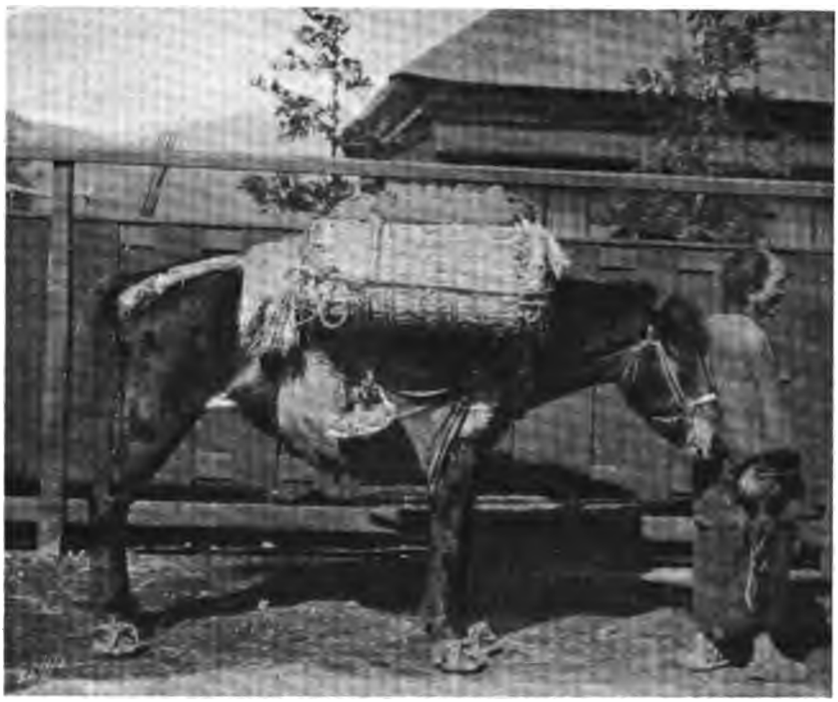

Fig. 606.—Japanese pack pony, with straw sandals on its feet.

before they are fully developed. The senseless jerking of the reins spoils their mouths, the numberless blows they receive make them stubborn, and the merciless insistence on speed causes their gait to become uneven, so that they keep changing into the canter, when they ought to be trotting.

"Until a few years ago the Battaks sold only stallions, because the mares bring them a large profit, without putting them to any expense or trouble. Also, Muhammadans do not like mares in their carts. The mares and foals feed all day on the grassy plains outside the villages ; at night they return to their owner's house, which stands on poles about ten feet high, and under which they spend the night in excellent fellowship with the cows, goats, fowl and other domesticated animals. Nothing is done in the way of taking care of them. Only when the colts have attained a saleable age, they get their first and last toilet, which consists of a slight rub-down with half of a cocoanut as a curry-comb, and then they are taken to market, in a halter made out of the fibrous part of an Aringa palm, and ornamented with white horse-hair tassels, as rosettes on each side. It is therefore easy to understand why the Battaks do not want to part with mares, unless these animals are barren, or worthless in other ways.

"Among the Battaks, horse-breeding is almost exclusively in the hands of the princes and village chiefs. The poor man is content if he can get a sufficiency of rice. If he succeeds in obtaining a brood mare, he cannot enjoy his possession, because the village chief would instantly become jealous, and would take the first opportunity to confiscate the cause of his ire."

Corean Ponies.—The indigenous pony of Corea is an extremely small animal, often not more than nine hands high. He is very handsome, being built on fine and graceful lines ; in fact, he looks like an Arab, or like the Iceland pony in Fig. 527. Despite the smallness of his size, and the slightness of his build, he is capable of doing a good deal of hard work. He seems to be of quite a different breed from the Manchuria pony.

Japanese Ponies are weak-bodied, long-legged animals of about 14 hands high. When I was in Japan in 1888, the ordinary working ponies of that country, instead of shoes, wore straw sandals (Fig. 606), which lasted only about a day. In the main island are used a large number of imported Mongolian ponies, which, being thick-set and short on the leg, differ a great deal from the indigenous animals, the best of which come from the province of Namba. There are several half-breeds which have been produced by a cross with English or American blood, and which show an advance in height and speed as compared with their local ancestors and with Mongolians. The Nippon Race Club has a very nice course on the Negishi Hill, which is about three miles from Yokohama. In the northern island (Hokkaido or *Zeze*) there is a distinct breed of ponies, which are weak and weedy.

CHAPTER XXXIII.

WILD HORSES.

Prjevalsky's horse—The Tarpan.

PROBABLY the only two living varieties of horses which have never been domesticated, and which consequently live in a wild state, are the Tarpan and Prjevalsky's Horse. It is possible, as suggested by some authorities, that tarpans are descendants of horses which escaped from domestication a very long time ago. Unfortunately, we have not sufficient evidence to decide this question.

Prjevalsky's Horse (*Equus caballus Prjevalskii*, Figs 607, 608, 609, 610 and 611).—Although I have seen a few of these animals in captivity, I shall be guided in making the following remarks chiefly by Salensky's admirable Russian book on this subject.

The Russian traveller, Prjevalsky, was the first to bring this animal to the notice of the scientific world, by presenting a skull and skin of a three-year-old to the Zoological Museum of St. Petersburg. On these somewhat scanty data, the Russian naturalist, Polyakov, wrote an article on this horse in 1881, and described it as a distinct species. Since that time, several living specimens have been imported into Russia, England and elsewhere, in which good work Herr Carl Hagenbeck, of Hamburg, has taken a prominent part. Professor Ewart has done invaluable service in determining the zoological position of this animal.

Home and Habits.—Prjevalsky's horse is found to the south of the Altai Mountains, and inhabits a district which, roughly speaking, is between the north latitudes of 46° and 48°, and between the east longitudes of 84° and 91°. "These wild horses frequent level deserts, and go at night to pasture lands and watering places. At break of day they return to their desert, where they rest till sundown. Asiatic wild asses, on the contrary, prefer to reside on land

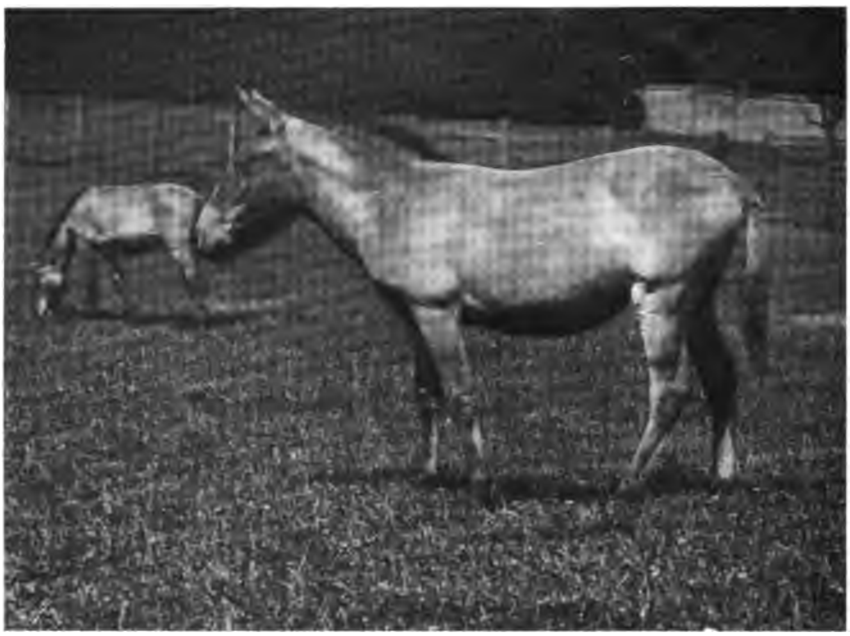

Photo by] [THE DUCHESS OF BEDFORD.
Fig. 607.—Prjevalsky's horse in summer coat.

at the foot of mountains. At break of day they come in herds out of the mountains to the pastures and watering places, and at sunset they return to the hills, where they pass the night. They generally like mountains covered with steppe-vegetation, but they will also remain on desert plateaux. Although we met large numbers of onagers and kiangs, we were unable to find out the place where they usually spent the night.

"The wild horses as a rule go in Indian file, especially

[illegible]

[illegible]

they invariably prefer to travel on the tracks which were previously made by other horses, than to select their own line. The supposed untamedness of Prjevalsky's horse has been disproved to some extent by P. K. Kozlov, and would not be accepted as a fact by any capable horse-breaker, without practical proof; although the animal, in all probability, is much more difficult to break in than an ordinary horse.

Photo by] [M. H. H.
Fig. 608.—Professor Ewart's yearling Prjevalsky's horse in summer coat.

Photo by] [M. H. H.
Fig. 609.—Professor Ewart's yearling Prjevalsky's horse in summer coat.

General conformation.—The usual height of Prjevalsky's horse is from 12 to 13 hands. He is a little taller at the croup than at the withers, and the length of his body is about equal to his height at the withers. Salensky states that the head is relatively larger than that of any other member of the horse family, and that the proportion which its length bears to that of the body, is about 1 to 2.21. Professor Ewart tells me that this proportion is 1 to 2.16 in his 2½ year-old Prjevalsky's colt, and that this animal's head is relatively longer than that of the Prjevalsky's horses at the Zoological Gardens, London. We may therefore infer that the comparative length of the head is greater than that of the race-horse or cart-horse (p. 184). Salensky also says that, relatively, the forehead is broader and the brain larger than in the domestic horse, as we can see by the "bumpy" forehead (p. 194) in living specimens. Here we have another proof that wild animals are more intelligent than tame ones (p. 202). Respecting the wild camel in the desert of Kum-tagh, Colonel Prjevalsky (*From Kulja*) says: "Unlike the domestic animal, whose chief characteristics are cowardice, stupidity and apathy, the wild variety is remarkable for its sagacity and admirably developed senses."

The muzzle of this horse is particularly broad, and the upper lip hangs a little over the under lip. The pelvis is more horizontal than that of the ass and zebra, and the bones of the pelvis and limbs are massive. As the height at the withers is about equal to the length of the body, the relative length of the legs is about the same as that of ordinary well-bred hunters. The usual number of loin vertebræ is five. The chestnuts and ergots are similar to those of horses in this country, except, perhaps, that the hind chestnuts are rather longer. The feet (Figs. 612 and 613) resemble those of the domestic horse, except that they are comparatively narrower, and consequently the heels appear to be "contracted." This peculiarity is unnaturally accentuated, to a moderate extent, in Fig. 613, because the pedal bone had been removed and the hoof allowed to get dry, before the photograph was taken.

Coat and colour.—Salensky tells us that the winter coat and summer coat of Prjevalsky's horse differ from each other in their length and texture, and also in their colour and markings. The winter hair is of a lighter colour than the summer hair. It is of a yellow dun on the back; gets gradually lighter on the sides of the body; and becomes almost white on the underneath surface of the trunk. With advancing years, this change of colour becomes less marked. The summer hair of the coat is smooth, and is much shorter than the hair in winter. It is of a dun colour on the back and on the upper sides of the body; but, on proceeding downwards, it gradually becomes lighter, until it reaches the lower part of the trunk, where it is of a cream colour. In this lack of uniformity of colour, which sometimes occurs in the domestic horse (p. 332), there is no

Photo by] [G. A. EWART.
Fig. 610.—Professor Ewart's 2½ year-old Prjevalsky's horse in winter coat.

comparatively sharp line of demarcation, as in the domestic ass (Fig. 397). The hair of the neck and the part of the head which is above the nostrils, is of the same colour as that of the back. The muzzle and lips are white, and the inner surface of the ears is covered with white hair. The hair of the legs becomes darker on approaching the fetlocks and pasterns, both of which are more or less black. The shade of the dun colour of the coat is by no means uniform. The colour, length and texture of the hair is, naturally, a good deal influenced by the surroundings.

Professor Ewart informs me that the depth of the colour of these animals which are in England, varies considerably; and that the colour of the muzzle and belly of his Prjevalsky's horse is only slightly lighter than that of the back.

"On the approach of winter, strong tufts of hair which Polyakov calls 'whiskers,' become developed on the side of the head, but they more or less disappear towards summer, at which time, the animal has a fairly long beard, between the branches of his lower jaw" (*Salensky*). Professor Ewart has observed this condition in Iceland ponies.

Stripes.—Salensky states that there is a thin dorsal stripe (p. 330), which is about half an inch wide, and which runs from the withers, down the centre of the back and croup, and down the dorsal aspect of the tail. It is clearly visible in the summer coat; but in the winter coat, it can be distinguished only on the croup, close to the tail. In its general width, it is similar to that of the horse. There is a transverse shoulder stripe, which can be seen much more clearly in the summer coat than in the winter coat. As it is not clearly defined, it more closely resembles the shoulder stripe which is sometimes seen in the horse (p. 330) than that of the domestic ass. Near the knees and hocks, there are more or less horizontal stripes which are similar to those in some horses (Fig. 398). The only difference I know between the stripes of Prjevalsky's horse and those of the domestic horse, is that the former are usually better marked than the latter.

On visiting the zoological collection of the St. Petersburg Academy of Sciences (*Academia Naook*) seven or eight years ago, Dr. Buchner, who was in charge of that museum, very kindly showed me the stuffed skin of a young Prjevalsky's horse, in which I could find no dorsal or shoulder stripes, and no horizontal stripes on the legs. The general colouring of the body was the same as in the ordinary Prjevalsky's horse. Professor Ewart tells me that the shoulder and leg stripes are almost imperceptible in his Prjevalsky's horse.

Mane.—This wild horse has practically no forelock, which, in his case, is almost as poorly developed as that of the onager. The hairs of the mane are coarse and stiff. During summer, they maintain an erect position (Fig. 607) and grow about 5 or 6 inches long. Towards winter, they

Photo by] [W. P. DANDO.

Fig. 611.—Prjevalsky's horses in winter coat.

increase in length, and arch more or less downwards to one side of the neck (Figs. 610 and 611). We may therefore regard the mane of this animal as intermediate between that of the horse and that of the Asiatic wild ass.

Tail.—The hairs of the tail on the back (dorsal side) of the dock, for about 8 inches from the root, are short, coarse and stiff. On the sides of the dock (as in the domestic horse), long hairs extend from the root of the dock to the end of the dock. This shortness of the hairs at the back of the dock, gives the tail somewhat the appearance of the tail of an ass, whose tail has, however, long hairs only at the end of the dock, in the form of a tuft (Fig. 616). The presence of short, coarse hairs on the upper portion of the dock, is often seen in ponies of Northern Europe, such as those of Iceland (Fig. 526). The tail is fairly long, and sometimes comes down to the ground (Fig. 610). The base of the tail of the animal in this illustration differs but little from that of the Iceland pony in Fig. 526, and of other Northern breeds.

Photo by] [M. H. H.

Fig. 612.—Outside view of fore hoof of Prjevalsky's horse.

Voice.—Prjevalsky's horse neighs in a manner similar to the domestic horse, and does not bray like the ass.

The Tarpan.—We read in de Simonoff and de Moerder's *Races Chevalines*, that at present, tarpans are to be found only in the distant steppes of Siberia and Central Asia. Up to the end of the eighteenth century, they abounded not only in these distant countries, but were also present on the grassy steppes of the south-east of European Russia. Gmelin (*Reise durch Russland*) saw them in the province of Voronej between 1733 and 1743. Fifty years ago, a few still remained in the province of Kherson and in the Crimea. One was captured as a foal in the former district in 1866, and was sent to the Zoological Gardens of Moscow, where it was alive in 1884. This animal was broken to saddle and harness, but it continued bad-tempered, although it had been castrated at the age of three years. Formerly these steppes were deserts, but soon after they began to be populated and cultivated, the

Photo by] [M. H. H.
Fig. 613.—Ground surface of fore foot of Prjevalsky's horse.

tarpans were exterminated, or driven away by the inhabitants. Tarpans are small and sturdy ponies, whose shape more or less closely resembles that of the Keergeez and Kalmouk steppe horses. The head is coarse, the forehead prominent (Fig. 292), the ears pointed, the eyes fierce and full of fire, the withers high, the croup rather drooping, and the legs strong and well shaped. They are inclined to be ewe-necked like the majority of the steppe horses.

The hair of the coat, which is usually mouse-coloured, is long and wavy, is (like that of other horses) of a greater length in winter than in summer, and is lighter under the belly than on the upper surface of the body. A black stripe runs down the back and croup (p. 330); the fore-lock, mane and tail, which are not as long as in the domestic horse, are darker than the body; the legs below the knees and hocks are nearly black. Tarpans are comparatively difficult to tame, and only those which were captured as foals could be broken in. Even then they remained bad tempered and unwilling workers. These animals roam the steppes in *kossiaks* (herds) composed of several mares, which are led by one stallion. These stallions show a great liking for domestic mares, and if they meet them on the steppes, they carry them off. Hence, this continued crossing with the domestic horse has no doubt altered the original type of the tarpan to some extent. The captured tarpan which was taken to Moscow, was of the typical mouse colour, except that its off fore leg was bay. Consequently, it is reasonable to assume that its blood was not quite pure. Shateelov, who made an elaborate report on this animal, states that it had no hind chestnuts.

There are only five lumbar (loin) vertebræ in each of the two skeletons of the tarpan which have been preserved —one in the St. Petersburg Museum of the Academy of Sciences, and the other in the Zoological Museum of the Moscow University. The tarpans from which these skeletons were taken, appear to have been lighter in build than Prjevalsky's horse; but any racial difference in this respect would naturally be the result of climate and soil (Chapter XXVI.). Absence of hind chestnuts and the fact that the number of loin vertebræ are restricted to five, are not distinctive characteristics of a separate species or even breed (p. 420 *et seq.*). The tarpan, supposing that he still exists, does not appear to possess any peculiarities which are not found in the domestic horse.

CHAPTER XXXIV.

ASSES, ZEBRAS AND EQUINE HYBRIDS.

Geographical Distribution of Wild Asses—Domestic Ass and Nubian Wild Ass—Somaliland Wild Ass—Onager—Syrian Wild Ass—Kiang—Mountain Zebra—Burchell's Zebra—Chapman's Zebra—Grant's Zebra—Crawshay's Zebra—Grévy's Zebra—Quagga—Horse and Ass Hybrids—Horse and Zebra Hybrids.

Geographical Distribution of Wild Asses.—These animals are found only in Asia and in North-Eastern Africa.

The Domestic Ass and Nubian Wild Ass (*Equus asinus*, Linnæus; or *Equus tæniopus*, Heuglin).—The domestic ass (Fig. 397) is evidently descended from the Nubian Wild Ass (Figs. 402 and 614), which is found in Nubia, Abyssinia, and other parts of North-Eastern Africa that lie between the river Nile and the Red Sea. The Nubian wild ass "is a fine animal, standing between 13 and 14 hands at the shoulder. It lives in small herds or families of four or five individuals, and is not found in mountainous districts, but frequents low stony hills and arid desert-wastes. It is as a general rule an alert animal and difficult to approach, and so fleet and enduring that, excepting in the case of foals and mares heavy in young, it cannot be overtaken even by a well-mounted horseman. Notwithstanding the scanty nature of the herbage in the districts they frequent, these desert-bred asses are always in good condition. They travel long distances to water at night, but appear to require to drink regularly. Their flesh is eaten by the natives of the Soudan. The bray of the African wild ass is said to be indistinguishable from that of the domesticated" (*Selous, The Living Animals of the World*). The statement that this wild ass cannot be overtaken by a well-mounted horseman needs proof, because the experience of Indian sportsmen has shown that the Onager, which is probably quite as fast a galloper and as good a stayer as the Nubian Wild Ass, can be caught by a capable rider on a good horse, supposing that the ground is not too rough. This subject is well elucidated by Mr. J. L. Harrington in Messrs. Tegetmeier and Sutherland's book.

The chief characteristics which distinguish this ass from other asses is the possession of a nearly vertical black stripe running down the shoulders, from the front of the withers; and the narrowness of the stripe down the back. These two stripes, which are, as a rule, only from a half to three-quarters of an inch wide, make the well-known cross. Sir William Flower states that the shoulder stripe is "sometimes double, and not infrequently altogether absent." This wild ass is of a light mouse colour except on the muzzle, under part of the body, and inside of the legs, which are more or less white. Its coat, particularly in the case of the domestic ass, may vary from white to a very dark brown, or even black, with tan "points." Both in a wild and tame state, it frequently shows dark horizontal stripes on its fore-arms. It resembles the mountain zebra in having very large ears, and a very large head compared to the length of its body. From ancient Egyptian records we learn that this ass was employed for domestic purposes in Egypt many centuries before the horse was known in that country. Its introduction into Europe, however, has been comparatively of recent date. It does not appear to have been known in England before the time of the Saxons, and did not come into general use until the beginning of the seventeenth century. The largest and strongest breed of donkeys is found in the French province of Poitou, where they are the wild ass of Thibet and Tartary. It seems to be identical with the onager, except that it is different in colour, more heavily built, has a coarser head, and that the stripe down the back is narrower. The colour of the kiang is a rather light brown, which is darker and redder than the light mouse colour of the onager; but is not red enough to be termed a bay. This ass is usually from 13 to 14

Photo by] [M. H. H.
Fig. 618.—Fore foot of onager.

hands high. It is far less wary than the onager, and consequently falls a ready prey to the would-be sportsmen who invade its domains in the high table-lands of Thibet.

The Mountain Zebra (*Equus zebra*, Fig. 310) was once very numerous in the mountains of Cape Colony and Natal, but now it has almost entirely disappeared from South Africa. A variety of this species is present in Angola

(Portuguese West Africa). Mr. Selous tells us that this zebra, which is also known as "The True Zebra," "seems never to have been an inhabitant of the plains, like all its cogeners, but to have confined its range entirely to mountain districts." We learn from Sir Cornwallis Harris that it never herded with the quagga or Burchell's zebra. It has a more tufted tail, a scantier mane, thicker neck and longer ears than the Burchell zebra. Its legs, especially

Photo by] [L. MEDLAND.

Fig. 619.—Kiang.

as regards the back-tendons and suspensory ligaments, are not as well suited to civilized requirements as those of the Burchell zebra. Its stripes are black or dark brown, on a white ground. The most distinctive difference between the arrangement of its stripes and those of other zebras, is the existence of a number of transverse ("gridiron") stripes, which run across the top of its loins, croup and tail. In some instances, this zebra is white on the underneath part of the body. With this exception, from the mountain zebra in being taller (its height is about from 13 to 14 hands), having a longer and thicker mane, a more bushy and less tufted tail, and smaller ears, and in the differences of its markings. The dark stripes are more brown than black, and the light coloured stripes vary from white to a yellowish cream. The stripes are broader and differently arranged (compare Fig. 310 with Fig. 621). There are intermediate (" shadow ") stripes on the hind

Photo by] [M. H. H.

Fig. 621.—Burchell's zebra.

quarters, and a characteristic black stripe runs along the under part of the belly. A broad stripe runs down the back, and there are no stripes across the top of the croup (Fig. 622). Its legs (below the knees and hocks) by their "flatness," and by the back tendons and suspensory ligaments being clearly defined, are much more like those of a well-bred horse than are those of the mountain zebra. It further resembles the horse by having a fairly lissom neck and a well-rounded barrel, and in the shape of its head and size of its ears. The typical Burchell's zebra has no dark stripes, or only very slight ones, below the elbows and stifles, on the legs, which are white; and the stripes on the hind quarters are relatively faint. The Orange River has been generally regarded as its southern limit. Mr. F. C. Selous, the celebrated African sportsman and naturalist, tells me that it "was first discovered by Burchell near the Orange River in Southern Bechuanaland. It is still to

Photo by] [THE ZOOLOGICAL SOCIETY.

Fig. 622.—Skin of Burchell's zebra.

be met with in Kama's country, and along the northern and eastern borders of the Transvaal. In the neighbourhood of the Pungwe River, it exists in very great numbers, herds of hundreds together being common." On account of the fact that this zebra, when in a wild state, possesses immunity from the effects of the bite of the tsetse fly, which is a carrier of death to horses, I strongly advocated, while I was in South Africa, the taming and employment for harness or saddle of these animals in

" fly " infected districts. With respect to this subject, Mr. Selous writes to me that : " although Burchell's zebra, born and brought up in the ' fly ' country, does not suffer from its bite, it is my opinion that if a young one was caught and brought up in a locality where there was no ' fly ' and was then taken into a ' fly ' infested district, it would die. This, however, is only my opinion." As the Burchell zebra is comparatively easy to break in, and

Photo by] [The Duchess of Bedford.

Fig. 623.—Chapman's zebra.

as it will breed in confinement, there is but little doubt that it will in time become domesticated. If, as is quite possible, it possesses little or no tendency to contract " horse sickness," it will prove a valuable means of conveyance in South Africa. During one of my horse-breaking performances in 1892, at Pretoria, the capital of the Transvaal, I made a young Burchell zebra, after about an hour's handling, quiet to carry a rider. In doing this, I did not throw the animal down, nor did I resort to any of the tan colour ; the belly is nearly white and at the most only crossed by faint continuations of the body stripes on their way from the dorsal to the ventral band; the hoofs are rounded in front, with long heels ; the frog is large ; the chestnut, only present on the fore leg, is small; and the tail carries long hairs only at its tip" (*Ewart*).

It has obtained its name from that of the late Presi-

Photo by] [M. H. H.

Fig. 628.—Fore foot of Grévy's zebra.

dent of the French Republic, to whom King Menelik of Shoa sent a specimen, as a gift, in 1882.

The Quagga (*Equus quagga*, Fig. 630) obtained its designation from its Hottentot name *quaha*. Up to the end of the first half of last century, it was found in immense numbers in South Africa, and appears to have become extinct about the year 1870. The last specimen in England died in the London Zoological Gardens in 1864. It was a strong, somewhat heavily-built animal, slow of pace for a wild member of the Equidæ, and comparatively docile. "A pair of imported quaggas were in the early part of last century driven about London in a phaeton by Mr. Sheriff Parkins. Lieut.-Col. C. Hamilton Smith, in his unpublished volume on the Equidæ, 1841, states that he

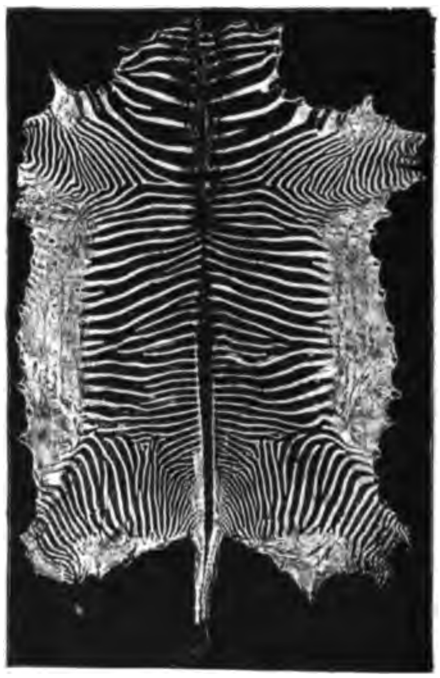

Photo by] [THE ZOOLOGICAL SOCIETY.
Fig. 629.—Skin of Grévy's zebra.

drove one in a gig, and that its mouth was as delicate as that of a horse. He further stated that it had better quarters and was more horse-like even than Burchell's zebra, and added: 'It is unquestionably the best calculated for domestication, both as regards strength and docility'" (*Tegetmeier and Sutherland*). Owing to its deficiency in speed and alertness, and to the value set on its hide by the Boers and on its flesh by their Hottentot servants, it was finally exterminated by the Afrikanders and natives. No attempt was made by naturalists to save this animal from extinction.

It stood about the height of the Burchell's zebra, and its colour on the shoulders and body was brown. The head and neck were marked alternately with white and dark-brown stripes, like those of the mountain zebra. There were on the shoulders and body some faint stripes, which

Photo by] [YORK & SON.

Fig. 630.—The Quagga.

gradually faded away as they went backwards. The colour was more or less white beneath the chest and belly, on the tail, except at its root, and on the legs below the elbows and stifles. It had a broad dark stripe down the back. It closely resembled Burchell's zebra, with the exception of being differently marked, and being more heavily built. It was evidently a zebra.

Horse and Ass Hybrids.—A mule is the produce of a jackass (male ass) and a mare; and a hinny, that of a stallion and a she-ass. Sometimes, the term, jennet, is applied to a hinny, which is incorrect, because the word, jennet (as used by Macaulay in his *History of England*), signifies a horse. In the United States, "jennet" means a she-ass, which animal is sometimes called in England, a "jenny" (familiar form of the word, Jane). In the word, jackass, "jack" means a male.

Agreeably to the remarks on page 434, about variation

Photo by] [C. REID, WISHAW.

Fig. 631.—Mule by New Forest donkey out of New Forest pony mare (11.2).

in breeding, we have the fact that no special distinction as regards appearance or conformation can be made between mules and hinnies, because, in both hybrids the proportional resemblance to horse and ass is of infinite variety. As mares are generally taller than she-asses; mules as a rule are of a greater height than hinnies, which is the only difference between these two hybrids.

Scientific research has amply proved that mules and hinnies are absolutely sterile, although cases are on record of induced lactation occurring in females of this kind.

Sanson tells us that the heavy draught Poitou mule, which is the offspring of the Poitou ass (p. 652) and the French cart mare, is often 17 hands high and weighs 700 kilogrammes (1,540 lbs.); and that he is an admirable heavy draught animal. These mules are frequently sold for from £40 to £100 a-piece. It is a matter of deep regret that the great utility of mules is practically ignored in our country, where the majority of the few mules (Fig. 631) produced, are very small, and are usually bred from comparatively worthless parents.

Horse and Zebra Hybrids (Figs. 632 and 633).—Like mules and hinnies, these hybrids vary greatly in their resemblance to their parents. Thus, the animal in Fig. 632 is like its sire; and that in Fig. 633, is like its dam. Since the end of the eighteenth century many hybrids of this kind have been bred, and of late years, Professor Ewart has taken a very prominent part in bringing this important industry before the public. He tells us that "there is every reason for supposing hybrids, between the large Somali zebra and the horse, would be as easily managed as ordinary mules, and for believing that in India and Africa they would be in every way more useful." Grévy's (Somaliland) zebra is much more powerful and active than the ordinary donkey, and his adaptability to draught, pack work, or saddle could be immensely improved by judicious selection in breeding.

CHAPTER XXXV.

EVOLUTION OF THE HORSE.*

General Remarks — Hyracotherium — Protorohippus — Orohippus — Epihippus — Mesohippus bairdii—Mesohippus intermedius—Miohippus—Protohippus—Pliohippus—Pleistocene Equidæ—Prehistoric horses—Causes of structural changes—Horses of the future.

General Remarks.—In considering the question of the evolution of the horse, we must bear in mind that evolution is adaptation to external conditions, in which climate and soil (Chapter XXVI.) play a large part; and that we have no proof of the existence of latent possibilities in an organism.

Instead of beginning the history of the horse at the earliest appearance of animal life on the earth, I shall attempt to trace it only through the Ungulata (mammals which have hoofs or blunt broad nails). Although we cannot hope to determine the exact sequence of the footsteps of the ungulates which, in their march of evolution, became gradually changed into horses; we shall find on their track, marks left by them or by near relatives who accompanied them on their journey, which will guide us in the right direction. As science progresses, the intervals between these landmarks will become gradually filled in; although it seems impossible that the position of every footprint can ever be accurately defined.

We learn from the study of palæontology, that living

* Whatever merit this chapter may possess is entirely due to the valuable and generous help I received from Professor Cossar Ewart, F.R.S.

creatures began to inhabit the earth after its crust, which was previously in a liquid state, had cooled down, and the action of physical causes, such as water and air, had commenced to form sedimentary rocks, in which the bones and other remains of then-existing animals became entombed as fossils. Thus, through countless ages, a history of animal life has been written in stone by the hand of Time. The last leaves of this book lie uppermost, while the first ones—unfortunately no longer legible—repose on fused rock, of which granite is a familiar example. This history is usually divided into (1) Archæan, in which no trace of animal or vegetable life is to be found; (2) Primary; (3) Secondary; (4) Tertiary; and (5) Quaternary (Post-Tertiary). The Tertiary period is divided into the Eocene (dawn of the recent), Miocene (less recent), and Pliocene (more recent) periods. The Quaternary includes the time from the close of the Tertiary to the present day, and is divided into the Pleistocene (Great Ice Age) and Recent. The last-mentioned period is that during which the existence of man became a prominent feature in the history of the earth, and is divided into Prehistoric and Historic. The Prehistoric cycle of time is divided into: (1) Palæolothic or Older Stone Age. (2) Neolithic or Newer Stone Age, and (3) Bronze Age. The Palæolithic has been subdivided into the older or Mammoth Age, and the newer or Reindeer Age. In Palæolithic times, the most elaborate weapons and implements made by man consisted merely of roughly chipped stones (generally flint) or bones, and the use of metals was entirely unknown. "The later or polished Stone Age; a period characterised by beautiful weapons and instruments made of flint and other kinds of stone, in which, however, we find no trace of the knowledge of any metal excepting gold, which seems to have been sometimes used for ornaments. This we may call the Neolithic period" (*Avebury*). By the advent of the Bronze Age, man had learned to manufacture that alloy from copper and tin, and began to make weapons with it, but he knew nothing of the working of iron, until the approach of historic times, the length of which is now about 7,000 years. The "Drift" (loose deposits of clay, gravel and sand) of the Great Ice Age was formerly regarded as a result of Noah's Flood, and consequently the Glacial Period was called the Diluvial Period, which term is frequently (though wrongly) used by Continential geologists.

The following is a summary of the foregoing periods :—

Quaternary.	Historic			
	Prehistoric	Bronze Age		
		Neolithic *(Newer Stone Age)*		
		Palæolithic *(Older Stone Age)*	Reindeer Age	
			Mammoth Age	
	Pleistocene or Great Ice Age			
Tertiary.	Pliocene			
	Miocene			
	Eocene			
Secondary				
Primary				
Archæan				

The above classification is merely one of convenience, because no sharp line of demarcation can be drawn between any of these periods, except the Archæan, the fused rocks of which form the floor of the graves of the ancestors and other relatives of all living things. Speaking of the Recent Period, Professor Lapworth, F.R.S., says : "These so-called ages in all likelihood shaded insensibly into the other. In some districts, stone implements were employed probably long after they had fallen into disuse elsewhere. In the later stone ages, unpolished tools were probably used for rough purposes, the smoothed examples being saved for fighting or the chase; and, even up to the present day, stone implements are more or less employed by certain savage tribes." Fifty years ago, war knives of bone and hard wood were in common use among the natives of New Zealand. Professor S. Schönland has pointed out that the Palæolithic Age has persisted in South Africa, until comparatively recent times, which is proved by the fact that the stone implements of the natives of that country are not polished in any way.

In tracing the evolution of the horse, we need not go further back than the Tertiary; because, during it, hoofed animals became for the first time abundant on the earth. "If the Secondary periods could appropriately be grouped together under the name of the 'Age of Reptiles,' Tertiary time may not less fitly be called the 'Age of Mammals.' As the manifold reptilian types died out, the mammals, in ever-increasing complexity of organisation, took their place in the animal world" (*Geikie*).

According to the calculations made by many palæontologists, the respective durations of the following periods may be estimated approximately as follows:—

Primary			17,000,000 years
Secondary			7,000,000 „
Tertiary	Eocene	2,100,000 years	3,000,000 „
	Miocene	600,000 „	
	Pliocene	300,000 „	
Quaternary			300,000 „
		Total duration of life on the earth =	27,300,000 „

The time since a solid crust was formed on the earth is variously estimated at from 25,000,000 to 100,000,000 years.

Calculations as to the duration of the Primary, Secondary and Tertiary periods are based chiefly on the time taken in the formation of sedimentary strata (which amount in thickness to about 20 miles), "denudations of the mountains, the filling up of the valleys by the *débris*, the formation of deltas, etc. The results give enormous stretches of time, but all of them unsatisfactory, because the methods are so very local in their application. The least objectionable attempt is that which, based upon astronomical calculations, tried to fix the height of the last Glacial epoch at about 200,000 years ago" (*Haeckel*).

During the Eocene and most of the Miocene ages, the climate of Europe, North America and Northern Asia was more or less tropical; but during the Pliocene it gradually became colder, until, during the Pleistocene, it assumed an Arctic character, and an extremely thick ice-sheet covered the greater part of Europe, and also a large portion of North America. "The ice in Scandinavia is believed to have been between 4,000 and 5,000 feet in thickness, and is calculated to have attained a thickness of 3,000 or 4,000 feet even in the Scottish Highlands" (*Lapworth*). "The previous denizens of land and sea were in large measure driven out, and even in many cases wholly extirpated by the cold, while northern forms advanced southward to take their places. The reindeer, for instance, roamed in great numbers across southern France, and Arctic vegetation spread all over Northern and Central Europe, even as far as the Pyrenees. After the cold had reached its climax, the ice-fields began to retreat, and the northern flora and fauna to retire before the plants and animals which had been banished by the increasingly severe temperature. And at last the present conditions of climate were reached" (*Geikie*). The Great Ice Age is generally supposed to have been due to astronomical causes (precession of the equinoxes).

The nature of the climate of a country during comparatively recent geological periods, can generally be ascertained by a study of the fossil plants and animals. Thus, the bones of tigers, for instance, would point to a tropical climate, and those of reindeer, to a cold one. "In drawing conclusions as to climate from fossil evidence, it is always desirable to base them upon the concurrent testimony of as large a variety of organisms as possible, and to remember that they become less and less reliable in proportion as the organisms on which they are founded, depart from the species now living" (*Geikie*).

Mr. Jukes-Browne (*The Student's Handbook of Historical Geology*) tells us that during the Eocene and Miocene periods, Britain was 2,000 or 3,000 feet higher out of the sea than it now is, and that in all probability England was connected with Ireland and France; Scotland, with Scandinavia and Greenland; and Greenland, with America. During the Pliocene period, "a movement of subsidence took place, by which a part at least of the British area was lowered considerably from the position it occupied in Miocene times. The area of the North Sea was submerged, and the Eastern part of England was also depressed beneath its waves." The great migration of the larger animals which took place during the Glacial Age, from Europe into Africa, was easily effected, according to Dr. Wallace, by the fact that these two continents were then connected at Gibraltar, at Sicily and Tunis, and at the Isthmus of Suez. "The large number of remains of Elephants and Hippopotami, and of other extinct Mammals, in the caves of Malta and Sicily, bear testimony to the extent of the land-connection here indicated, which could only have been brought about by a considerable lowering of the Mediterranean waters" (*Hull*).

In searching through the records of the past, an examination of fossil limbs and teeth is particularly interesting; because we can obtain from it, direct and clearly expressed evidence respecting the capacity of movement and mode of feeding possessed by animals which inhabited the earth many thousands, if not millions, of years ago. To aid those of my readers who are not acquainted with the anatomy of the horse, I have given a brief description of the bones of his limbs on pages 36 to 38, and of his teeth on page 49.

In examining the body of the horse, we find many vestigial structures which are more or less useless to the present possessor, but which appear in a better developed condition in certain horse-like fossils. Thus, the splint bones extend lower down in the Pliohippus (Fig. 643), than in the horse of to-day; in the Protohippus of the Lower Pliocene, each of these bones is furnished with a pastern and hoof, which, according to Marsh, did not come to the ground; and in the earlier Mesohippus, the digits of the splint bones are larger, and evidently took part in progression. The general anatomical characters of these fossil animals were evidently horse-like. Von Baer wisely suggested that the history of an individual is the history of its species; although, as Bateson points out, "if it be generally true that the development of a form is a record of its descent, it has never been suggested that the record has been complete." The elaborate investigations of Cossar Ewart show us that a horse, during the early (embryonic) stages of his life, has, like the Mesohippus, three digits on each limb. The vestigial (second and fourth) digits are best developed when the fœtus is about 22 weeks old, at which time it is about 14 inches long. The first joint (that between the metacarpal bone and the long pastern bone) of these digits persists till after birth; th second joint (that between the long and short pastern bones) is the first to go; and the third joint (that between the short pastern bone and the pedal bone) is the next to disappear, which it does, when the fœtus is about five months old. Although the digits of the splint bones gradually degenerate as the fœtus increases in size, they can still be indentified at birth, in the bulb ("button") at the end of their respective splint bones. Professor Ewart (*Experimental Contributions to the Theory of Heredity*) points out that "this warrants the deduction that, as one-hoofed recent horses are related to three-hoofed Pliocene forms, the latter are related to the still older five-hoofed primitive Eocene Ungulates." Also, we occasionally find in the horse, that one or both of the splint bones are provided, like the cannon bone, with a more or less perfect pastern and hoof. In fact, there have been well-authenticated instances of horses which were so completely furnished in this respect on their fore feet, that, instead of being shod on only four hoofs, they carried iron on eight, namely, three shoes on each fore foot, and one shoe on each hind foot. Of course, the four supplementary shoes were applied merely for

Photo by] [M. H. H.
Fig. 634.—Off fore leg of horse with second digit.

exhibition purposes. Such a digit is well shown in Fig. 634, which is a reproduction of a photograph of the abnormal foot of a pony mare I took in Surrey in 1894. This mare, which was about 13.2 high, and which was of the light trapper class, suffered no inconvenience from the presence of this vestigial digit. At the time I took the photograph, she had by her side a smart and healthy foal, whose feet were normal. Fig 635 represents the bones of a colt's near fore leg which was given by Professor Goubaux to the Veterinary College of Alfort. Apparently, these abnormal digits are not monstrosities, like the sixth finger or toe which is sometimes found on the hand or foot of a human being, but are reversions to a former type. If, however, there are two digits to one cannon bone, as sometimes happens (Fig. 636), the abnormality is one of dichotomy (splitting into two), and not of reversion (or atavism). Fig. 637 shows a case of dichotomy in an ox, which had three,

Fig. 635.—(*After Gaudry.*) Near fore leg of horse, below the knee, with second digit.

instead of two, digits on each of its feet; both fore and hind. Professor Dunstan, M.R.C.V.S., to whom I am indebted for this photograph, tells me that the abnormality in this case appears to have been inherited, because the dam had three digits on each of its fore feet. The cannon bone of the ox, although it appears to be only one bone, consists of the 3rd and 4th metacarpal (or metatarsal) bones, which are separate during the early life of the fœtus, but become united before birth. As no normal ancestor of man had more than five digits on a hand or foot, we are justified in regarding a sixth finger or toe as a monstrosity. The foregoing considerations give us reasonable cause for assuming that the horse, like other animals, is a product of evolution, and not of special creation.

For our knowledge of equine evolution, we are chiefly

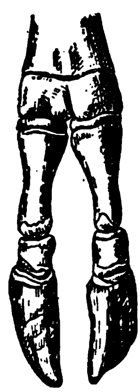

Fig. 636.—Front view of off fore foot of horse, with pedal and pastern bones split, and a hoof on each half of the pedal bone (*After Boas*).

Photo by] [J. DUNSTAN.

Fig. 637.—Case of dichotomy in the fore feet of an ox.

indebted to the late Professor Marsh of Yale College and Professor Osborn of the American Museum of Natural History, who have discovered numerous species of equine fossils in America, of which country the ancestors of present equine varieties appear to have been natives. In fact, both North and South America were largely inhabited by these animals. In other parts of the world, horse-like forms were evolved, but none of them can be reckoned amongst the ancestors of the horse. The Hipparion gracile

(Figs. 638 and 639), which had many horse-like characteristics, has been found in Europe, Asia, North Africa, and

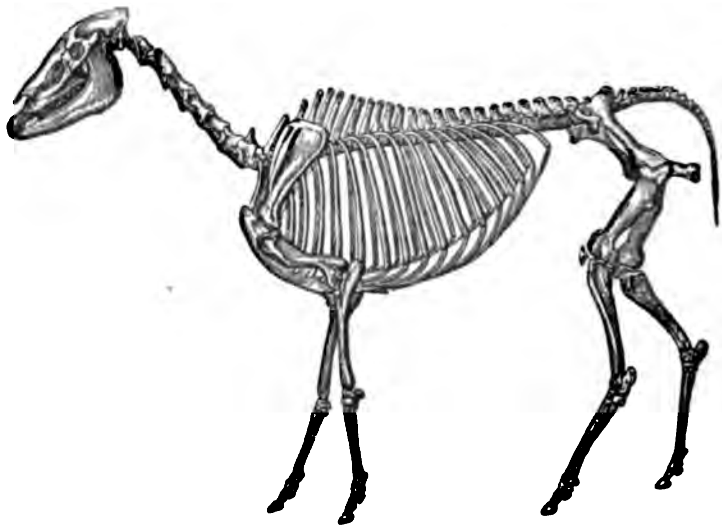

Fig. 638.—(*After Gaudry*) Hipparion gracile ($\frac{1}{10}$ actual height).

Fig. 639.—Front view of near fore leg of Hipparion gracile, below the knee ($\frac{1}{4}$ actual length).

America; but, as Sir William Flower (*The Horse*) remarks, it is evidently not an ancestor of the horse, because it differs greatly from the horse in its teeth, and by the fact that it possessed a deep depression in front of each eye, in which depression was lodged a large tear or scent gland, similar to that found in several kinds of deer and antelope. Had the H. gracile been in the genealogical line we are

Fig. 640.—Front view of near fore leg of horse, below the fore-arm (¼ actual length).

considering, this depression would not be entirely absent in the horse; because the upper Miocene and Lower Pliocene ages, during which this three-toed Hipparion lived, are not very remote periods, from a geological point of view. The H. gracile was between 13 and 14 hands high. Von Zittel (*Handbuch der Paläontologie*) gives a very lucid description of the structural characteristics of this animal, which apparently has left no descendants. The bones of a horse's fore leg, below the fore-arm, are shown in Fig. 640.

One of the most remote ungulate ancestors of the horse is Phenacodus primævus (Fig. 641), which "is antecedent to all the horse series, the hog, the rhinoceros, and all the other series of hoofed animals" (*Cope*). Phenacodus, which belongs to the early Eocene period, had five digits

Fig. 641.—Phenacodus primævus ($\frac{1}{12}$ actual size).

on each limb, and three phalanges on each digit, which is a more complete arrangement of the hands and feet than is possessed by any normal animal. In our own case, the thumb and big toe have only two phalanges, and in the little toe, two of the three phalanges are sometimes united. In Phenacodus, the ulna and fibula were entire, and separated from, respectively, the radius and tibia; and there was no interlocking of the carpal (wrist) bones. Phenacodus had what is regarded as a typical set of teeth, namely, 22 in each jaw (44 teeth in all). The incisors were small and had sharp edges, and the canines were well developed in both male and female. There was no *diastema* (interdental space) between the canines and premolars, which differed from the molars by being smaller and simpler in form. The molars had very short crowns, each of which had six cusps (prominences). The skull and brain were small, and the head was carried nearly in a line with the neck.

Phenacodus, whose remains have been found in America and in Switzerland, somewhat resembled a wolf in appearance, and was about twenty-one inches high. He walked

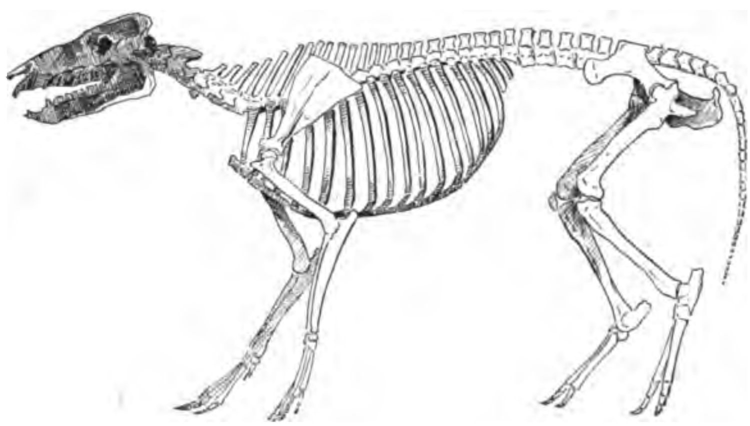

Fig. 642.—Hyracotherium ($\frac{1}{3}$ actual height).

chiefly on his 2nd, 3rd, and 4th toes, which were provided with small hoofs; the 3rd toe being wider and longer than the others. He was active, had a long tail, powerful hind quarters, was probably omnivorous and inhabited swampy ground and low-lying forests. His enemies were probably Creodonts, which in Eocene times represented our carnivora (flesh eaters). The following forms are believed to connect this extremely primitive ungulate with the recent Equidæ.

Hyracotherium (*Eohippus,* Fig. 642), was found by Professor Marsh in the Lower Eocene of New Mexico, and several species have been described, "all about the size of a fox." The name, Eohippus (Horse of the Eocene), implies that its remains were found in Eocene deposits. Hyracotherium, like many of the mammals of the Eocene epoch, inhabited Europe as well as America. The 1st digit was absent in all the feet, and the 5th digit was present only in a vestigial form in the hind ones. The bones of the wrist (knee) were becoming interlocked, as in the horse, but the ulna and fibula were still complete and separate, as in Phenacodus. "In the structure of the feet and teeth, the Eohippus unmistakably indicates that the direct ancestral descent of the modern horse had already separated from the other perissodactyles, or odd-toed ungulates" (*Marsh*).

The canine teeth were everted (bent outwards) and well developed, the incisors separate and chisel-shaped, and the premolars quite different from the molars. The 3rd premolar had three cusps; and the molars, six cusps. The orbit was incomplete, as in the dog, and the brain was larger than that of Phenacodus. The food of Eohippus appears to have been succulent grasses.

Protorohippus was about 18 inches high and closely resembled Eohippus, except that it had no vestige of the 5th digit in the hind foot, and was more horse-like.

Orohippus (*Pachynolophus*, Fig. 643), which was found in America, received its name from Professor Marsh, apparently because he regarded it as the limit (Greek, *oros*, limit; and *hippos*, horse) to which horse-like animals can be traced. Its resemblance to the equine type, though still distant, was closer than that of its predecessors. The last two premolars had gone over to the molar series. "Orohippus was but little larger than Eohippus, and in most respects was very similar. Several species have been found, but none occur later than the Upper Eocene" (*Marsh*).

Epihippus, which made a further approach to the horse type, in having the 2nd premolar more like a

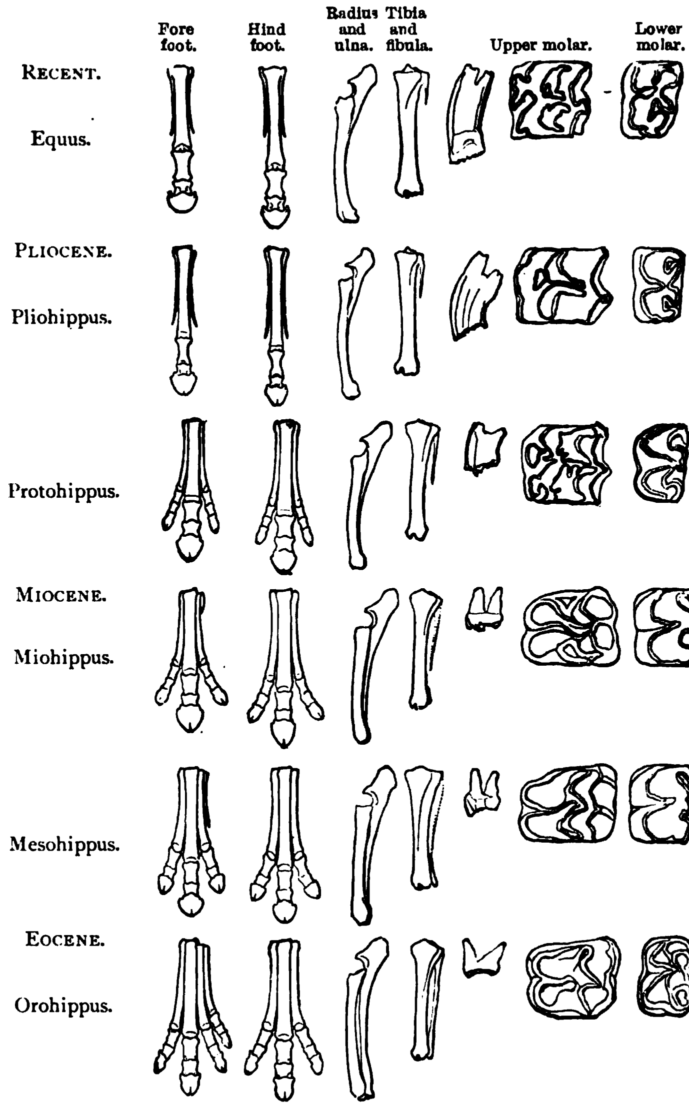

Fig. 643.—Evolution of the bones of the legs, below the elbow and stifle, and molar teeth of the horse. (*After Marsh*). The fossil remains of Eohippus were found, after Professor Marsh had made this table.

molar than was the case in Orohippus, was found in the Upper Eocene of Wyoming. As in Orohippus, the 3rd and 4th premolars resembled molars. The canines were a little stronger than the incisors, and were separated from the back teeth by a wide *diastema* (interdental space).

Mesohippus bairdii (Fig. 643).—" Near the base of the Miocene, we find a third closely allied genus, Mesohippus, which is about as large as a sheep, and one stage nearer the horse. There are only three toes and a rudimentary splint on the fore feet, and three toes behind. Two of the premolar teeth are quite like the molars. The ulna is no longer distinct or the fibula entire, and the other characters show clearly that the transition is advancing " (*Marsh*). The " rudimentary splint on the fore feet " was a vestige of the 5th digit. The limbs had increased in length, and in some cases were comparatively longer than in recent horses ; the animal inhabited more open ground than its ancestors, and, to judge by its teeth, its food was harder and dryer than theirs. The canine teeth were still comparatively large, and the corner incisors were cupped, and were beginning to show the " mark." The second premolar was frequently like a molar.

Mesohippus intermedius.—In this species, the middle incisor was slightly cupped. The vestige of the 5th digit on the fore feet was smaller than in M. bairdii, and the vestigial (2nd and 4th) digits varied considerably in strength, which fact implies that they were no longer of much importance in the struggle for existence.

Miohippus (*Anchitherium prestans*, Fig. 643), is found in the Upper Miocene of America, and was about the size of a donkey. It had a very small vestige of the 5th digit in front, and the vestigial (2nd and 4th) digits of both fore and hind limbs were slender. The middle incisor was well cupped. The depressions in the tables of the molars were not filled with cement. The term, Miohippus, means "Horse of the Miocene."

Protohippus (Fig. 643).—"The genus Protohippus of the Lower Pliocene is yet more equine, and some of its species equalled the ass in size. There were still three toes [2nd, 3rd and 4th] on each foot, but only the middle one, corresponding to the single toe of the horse, comes to the ground. This genus resembles most nearly the Hipparion of Europe" (*Marsh*). Respecting Professor Marsh's remark about the 2nd and 4th toes not coming to the ground, we have the fact, already alluded to (p. 320), that some horses, especially high-caste Arabs, have such a large amount of "play" in the fetlock and pastern joints of the fore-legs, that during the fast gallop, the fetlock pad frequently comes down on the ground, and is liable to get bruised. As this "play" (extension) of the joints of the foot must have been much greater in the Protohippus than in our horses, and as the 2nd and 4th digits of the fore legs of this equine fossil were nearly on a line with the coronet of the 3rd digit; the decadent digits of Protohippus must have come to the ground at fast paces, if not in slow movement, especially on soft soil, and when going down hill.

Protohippus, which lived chiefly on plains, seems to have been evolved in North America, from which it extended southwards into South America, and eastwards into Asia. As the last vestige of the 5th digit vanished; the inner incisor became cupped—like the middle and outer incisors—and developed a "mark"; and there was abundant cement. Though the 2nd, 3rd and 4th premolars and all the molars had longer crowns than in the less specialised Miocene forms, the 1st premolar was of considerable size. The orbit was complete in Protohippus, and the skull closely resembled that of living horses.

Pliohippus (Fig. 643) was about 14 hands high, and its fossil remains are found in the Pliocene of America. It was very equine in type, and had only one hoof on each leg; the 2nd and 4th digits being in a vestigial condition under the skin. The splint bones were a little longer than those of the horse, but did not come quite down to the fetlock joint. All the incisors were well cupped, and were also partly filled with cement. The canine teeth, like those of the horse, were comparatively small. The 2nd, 3rd and 4th premolars were identical with the molars; and the length of the crowns of both premolars and molars was about intermediate between those of Protohippus and the horse.

Pleistocene Equidæ.—Horses "made their first appearance in the Upper Pliocene; they extended over North and South America, Asia, Europe, and North Africa, during the Pleistocene; and became extinct in America before the beginning of the Historic period" (*von Zittel*). No satisfactory reason has been given for their extinction in America. All available evidence points to North America as the area in which the ancestors of the horse were one by one evolved, and from which three-toed and, later on, one-toed forms came by natural migration from America into Asia. This migration must have occurred in pre-historic ages, when North America was united to Northern Asia. The subsidence of the land which is now covered by Behring Strait and by the Sea of Kamtchatka, severed this connection, apparently during the continuance of the conditions which had destroyed equine life in North America; because no natural return of horses from Asia to America seems to have taken place, although horses bred freely and prospered all over the American Continent, after they had been brought over from Europe by the Spaniards, long before which time, the agency that had caused equine extinction throughout America, must have ceased to act. According to Wallace (*Island Life*), the camel tribe made a similar migration from America into Asia, over the now-submerged land which had formerly united the two continents. There is no evidence to show that asses or zebras were evolved in America.

In horses, asses and zebras, the splint bones, ulna and fibula are shorter, and the crowns of the molars and of the molar-like premolars are longer than those of Pliohippus. The carpus (knee) is firmly interlocked, the incisors are closer together, the canines are smaller, and the 1st premolar is in a vestigial condition, although, as observed by Professor Ewart, it is present in the embryo. He has also shown that it is sometimes as large in zebras, as it was in Protohippus. The lengthening of the crowns of the molars and of the molar-like premolars shows that the gradual adoption of a harder form of herbage as a food, was a well-marked factor in the evolution of the horse.

From Phenacodus to the horse of to-day, the 3rd digit has remained the principal one of both fore and hind limbs. It is interesting to note that the digits and phalanges of the fore legs have a less tendency to decrease in number than those of the hind limbs, evidently because their functions are more numerous. In man, the toes are smaller than the fingers, and are less mobile. Occasionally in the little toe, as already stated, two of the phalanges coalesce; although, in the little finger, all these phalanges remain separate. In the case of the re-appearance of the 2nd (as in Fig. 634) and 4th digits in the horse, the fore feet are more frequently supplemented in this way than the hind ones.

Equus stenonis is a name which has been given to a group of horse-like animals that inhabited Europe during the Pliocene and Pleistocene periods. Their remains, chiefly teeth, have been found principally in Algeria, France, Switzerland, Italy and England. The study of their teeth proves that there were two or more varieties or species, to which various names have been applied. In 1884, M. Ph. Thomas (*Mémoires de la Société Géologique de France*) having obtained, from a Pleistocene deposit in Algeria, the lower jaw of a young animal of this order, which he called *Equus asinus atlanticus*, noticed that its 3rd* milk premolar had a small column or pillar of enamel, at its posterior and external angle, where it is surrounded with cement, and where it appears on the crown of the tooth in the form of a small circle (Fig. 644). As the position of this pillar is entirely different from that of the Hipparion (p. 683), its presence shows that the Hipparion is not an ancestor of this variety of Equus

Fig. 644.—3rd lower left premolar of *Equus asinus atlanticus* (*After Marcellin Boule*).

Fig. 645.—3rd lower left premolar of Burchell's zebra (*After Marcellin Boule*).

stenonis. While carefully investigating this subject, M. Marcellin Boule (*Bulletin de la Société Géologique de France*, 3e série, tome XXVII., page 531, année 1899), failed to find this pillar in milk premolars of horses and asses (tame or wild), and consequently inferred that *E. asinus atlanticus* was not in their line of descent. On further research, he discovered that the 3rd lower milk premolar of Burchell's zebra (Fig. 645) has a pillar of enamel similar in shape and position to that of *E. asinus atlanticus*; and that the teeth of this fossil resemble those of Burchell's zebra much more closely than they do those of the horse and ass. Also, he cites the important fact that the Algerian deposits in which *E. asinus atlanticus* was found, contained the remains of many tropical animals that, like the hippopotamus and rhinoceros, have long since quitted North

* This 3rd premolar is the one which I have called the 4th premolar on page 49.

Africa and have taken up their abode in Southern regions which are now the home of Burchell's zebra. Hence, it has been assumed that the ancestors of this zebra took part in this migration, which was apparently caused by the increasing cold of the Glacial Age. These considerations seem to indicate that *E. asinus atlanticus* was an ancestor of Burchell's zebra, but not of the horse or ass.

M. Boule has also found this pillar of enamel in the milk teeth of specimens of *E. stenonis* obtained from deposits in Puy-de-Dôme, Haute Loire and Val d'Arno.

Unfortunately, we have no information as to the time when the mountain zebra and quagga departed from the line of descent of the horse.

M. Boule points out in his admirable paper that there were two varieties of *Equus stenonis*, namely, *Equus ligeris*, and *E. robustus* (*E. plicidens* of Owen). The former, which is the one he considers to be an ancestor of Burchell's zebra, was of comparatively small size, and the enamel of its molar teeth took far less complicated forms than that of the horse. The latter was comparatively large, and its enamel was folded in a manner somewhat similar to that of the domestic horse, which M. Boule regards as a descendant of *E. robustus*. As the horse thrives best in a temperate or cold climate, and as the zebra is a tropical animal, we can readily understand that, although the intense cold of the Great Ice Age banished the *E. ligeris* tribe from Europe and North Africa, it had not a similar effect on the *E. robustus* tribe, which can now be found in a wild state in parts of Siberia that are not very far from the Arctic circle. As Darwin suggests, the instinct which horses possess of scraping away, with their fore feet, snow that covers the ground, so as to get at the underlying grass, shows that they probably came from a country in which the winters were severe.

Although scientific research has been unable, up to the present, to tell us what animal was the latest common ancestor of the Equidæ of to-day, the fact that asses and zebras are of an older type than the horse, justifies us in assuming that the common equine ancestor resembled them more closely, than he resembled the horse. The remarks made on page 424 show that our present horses are probably descended from two equine varieties which differed from each other, as regards hind chestnuts, ergots, and loin vertebræ. Structural size does not affect this question, because size depends chiefly on climate and soil, as we have seen in Chapter XXVI.

Prehistoric Horses.—Cuvier (*Recherches sur les ossements fossiles*), Sanson (*Comptes rendus de l'Academie des Sciences*, 1873), Piétrement (*Les chevaux dans les temps préhistoriques et historiques*), and other distinguished palæontologists are agreed that no exact information has been obtained about the species to which these animals belonged. The fragmentary character of their remains (bones and teeth) and the fact that some of these prehistoric horses were more like asses and zebras than our present horses are, greatly increase the difficulty of this question.

From fossil remains found in caves of various countries, it appears that wild prehistoric horses roamed in large numbers over Europe and Asia during the Older Stone Age, and furnished food to Palæolithic men, who were savages that lived by hunting. These people evidently took great delight in eating the marrow and brains of their equine prey; for the large collections of equine bones in caves of France and Belgium are chiefly made up of the long bones of the limbs and bones of the head; both having been fractured as a rule by means of flint "knives." The fractured parts of these heads consist almost entirely of bones which covered the brain, and consequently the lower jaws are generally entire, and the upper ones broken in pieces. The nature of the cleaving instruments is shown by the fact that many of these flint "knives" and splinters from them have been found in the osseous *débris*, and that grooves and scratches have been made on the bones during the process of fracture. Similar grooves and scratches on other parts of the bones, indicate that the wild hunters removed both flesh and hides by means of their roughly-fashioned flint instruments.

"In the Trou de Chaleux, 157 tail vertebræ of prehistoric horses have been found. As they are all thrown about in disorder, and as extremely few of the first four tail vertebræ were among them, M. Dupont infers that the inhabitants of that place used to dock horses at the fifth or sixth vertebræ, where disarticulation is easy, only to obtain the long hair, and not to keep the tails as trophies" (*Piétrement*). They probably employed this hair as string.

Professor von Zittel tells us, that mankind inhabited Europe, North Africa, Asia, North and South America, and probably other parts of the world, during the Pleistocene period; but although it is probable that human beings existed in the Tertiary age, we have no positive evidence on that point.

With respect to the question of these horses being wild or domesticated, M. Piétrement emphasises the fact, that in the case of the fossil remains at Solutré, which is near Mâcon (Saône-et-Loire), the large majority of horses that have been killed by prehistoric men, were from five to seven years old. He states that "when a herd of horses at liberty is attacked by carnivora, which make their onslaughts in a manner similar to those of Quaternary men who were armed with weapons of chipped flint, the horses form themselves into a circle or semi-circle, according to the nature of the ground and the severity of the attack. The strongest animals place themselves on the outside of the line, which is the most dangerous post; and the foals and brood mares take refuge in the centre, or escape in the direction opposite to the assault. It is therefore certain that in such attacks on horses living in the open, vigorous and mature animals would be the chief prey of the hunters."

We may reasonably conclude that the domestication of horses was begun in the Neolithic age. Rütimeyer (*Fauna der Pfahlbauten in der Schweiz*) and other palæontologists "have shown that the men of the Newer Stone Age kept domestic animals, not only on account of the appearance of the bones of these animals, but also on account of the comparatively advanced degree of civilisation of these people, who knew how to build houses on piles, weave cloth, cultivate various cereals, and make bread from them, as is evident by the fact that burnt grains and burnt bread have been found in the mire of these lake-cities, along with rags of cloth and dung of domestic animals which lived in these places. The agricultural condition of the Neolithic people in the West of Europe is an absolute proof that they kept domestic animals; because everywhere, the grazing of cattle has always preceded agriculture" (*Piétrement*).

After citing the results of researches made by many trustworthy palæontologists, M. Piétrement states: "It is therefore certain that man continued to eat horses during the Neolithic period in the West of Europe, although many of the equine bones of this age which were found to the south of the Loire, must be regarded as belonging to asses. Evidently, Neolithic horses also trod the soil of Belgium." Mr. F. C. Selous tells us in *The Living Animals of the World*, "that Grévy's zebras become very fat at certain seasons of the year, and their flesh is much appreciated both by natives and lions." "The establishment of Christianity was the sole cause of the abolition of the eating of horse-flesh in Central Europe, as we may see by the two prohibitory letters which the Popes Gregory III. [A.D. 731] and St. Zacharias [A.D. 741] sent to Boniface, the apostle of Germany, and which are mentioned by Isidore Geoffroy Saint-Hilaire, in his *Lettres sur les substances alimentaires*" (*Piétrement*). The fact that the eating of horse-flesh was a part of the ceremonies in the worship of Odin, was the cause of its being prohibited by ancient Catholic priests and their followers. "St. Olaf, the cruel king who converted the Scandinavians to Christianity by the sword, put to death or mutilated all who persisted in using that heathenish food" (*Rollo Springfield*).

Men of the Reindeer Age had evidently some knowledge of drawing and sculpture, because they left behind them many representations of equine animals, most of which are depicted with upright manes, scanty tails, and no fore-locks; and a few, with stripes. With respect to the manes, tails and absence of forelocks, some of the animals in question would readily pass for Prjevalsky's horses (p. 640). With regard to the stripes, we have the important fact that horses of the present day often have stripes (p. 330), and the stripes as a rule are more distinct at birth, than when grown up.

Causes of Structural Changes.—Variation plays a large part in every species of animals, and the members that succeed best in the struggle for existence, are those whose physical and mental powers are most suitable to their surroundings. Hence, evolution is the result of favourable variation being transmitted by heredity. We have seen in this chapter that the change in the teeth of the horse family has been caused by the forage (and its producer, the soil) becoming gradually drier and harder. The fact that the feet of the tapir have undergone, practically, no modification for millions of years, proves that his present conditions of life are nearly the same as they were when the ancestors of the horse, like those of the tapir, had 4 digits on each fore foot, and 3 on each hind one. Feet like these, which, under the influence of pressure, had the faculty of spreading out, were admirably suited for going through soft ground similar to that over which the tapir still roams in a wild state; because the increase of the area of support thus offered by the feet, was a direct help in preventing the animal from sinking too deeply in the mud over which he travelled. It is evident that this lateral play of the digits entailed loss of speed in progression on hard ground, on account of expenditure of muscular power required to restore them to their normal position, and from increased friction. The less lateral play the digits have, the faster would the animal be able to travel over hard ground. We may therefore infer that the decrease in the number of the digits of the horse's foot, has been due to residence on increasingly dry soil during many thousands of generations. With the loss of lateral play in the foot, there has been a consequent increase of speed, which was necessary for protection against the attacks of carnivorous animals, like the puma, wolf, and lion, whose conformation was unsuited for predatory operations in the morasses which afforded an asylum for ancestors of the horse.

Evolutional specialization in one structure is not necessarily accompanied by specialization in other structures. Although, as regards the number of toes, the horse's foot is better suited for high speed than that of any other animal; the fact remains that (for instance) the cheetah (Fig. 3), hare, wolf, and wild dog, which have four working toes on each foot, are comparatively much faster than any wild horse or ass, because their muscles are relatively a great deal longer. The extreme length of the limbs of the black buck (Fig. 1) compensates him to a large extent for the disadvantage of having two working toes on each foot. In his ancestors, the tendency to place weight both on the third and fourth toe, was so evenly distributed on these two digits, that the balance between them has remained practically undisturbed for ages, and under modifying conditions which have nearly doubled the comparative length of his limbs.

The Horse of the Future.—We have seen that the bones of the legs of the horse are gradually assuming the character of a single column. In the wrist (knee) of the pig, like that of early ancestors of the horse, there are 8 small bones, one of which (the trapezium) articulated with the first digit, which has long been lost. The trapezium is occasionally found in the horse, and then, only in the form of a small nodule. In the hock of ancestors of the horse, like that of the present pig, there were 7 small bones, 3 of which are called cuneiform bones; but in the hock of the horse, there are as a rule only 6 small bones, the cuneiform bones being limited to the large and small cuneiform. Out of 49 sound hocks which Joly examined at Saumur, 8 had only 5 small bones, in which cases, the two cuneiform bones were fused together, like the third and fourth metacarpal and metatarsal bones of the ox (p. 682). There is also an increasing tendency to bony union between the splint bones and their respective cannon bones. Thus we find that comparatively harmless forms of "simple" splint and "low" spavin are increasingly common among young horses that are subjected to civilized conditions, which evidently entail more concussion and strain on the limbs, than natural conditions would do. Agreeably to these changes, we have the fact that such splints and spavins are less liable to injuriously affect the usefulness of a thorough-bred than of, for instance, a Mongolian pony or a South American broncho. We may therefore conclude that as ages roll on, the splint bones will disappear, and that, *pari passu*, the small bones of the knee and hock which rest on them will also vanish. Among other changes, the bones of the sternum will in time become joined together, and anchylosis will take place between the pelvis and sacrum. The racehorse will become comparatively longer in the legs and neck, stronger in the loins, and lighter in the back ribs (like the greyhound, Fig. 8) than he is now; and the draught animal will become shorter in the limbs, and more massive in muscle. Both will increase in height and docility.

CHAPTER XXXVI.

PHOTOGRAPHING HORSES.

PHOTOGRAPHY is a very useful aid for the acquisition of a knowledge of conformation ; for it enables us to place on record exact results unobtainable by any other means.

Photographs are taken of a horse with the object of obtaining a picture, a portrait, a combination of the two, or a likeness of the animal by which his " points " may be best seen and correctly compared with those of other horses. When a picture is the end in view, the pose will have to be subordinated to artistic requirements. If a portrait, the position should be that which will convey to the spectator the best possible idea of the general look of the animal. This will usually be obtained when his body is in profile, and the head and neck carried in the manner most characteristic of the horse in question. I think that horses in photographs look better when the head is turned a little towards the observer (Figs. 463 and 516) or is directed straight to the front (Fig. 416), than when it is turned even slightly away (Fig. 342). When, however, the photograph is required as a more or less exact record of the horse's "make and shape," he should be as nearly as practicable at right angles to the line of sight (Fig. 436), and not foreshortened (Fig. 533) : just as if he were posed for the inspection of an intending buyer. Some photographers like to have the hind-quarters of a horse nearer the lens than the fore-hand, apparently with the object of giving the animal a particularly small head. In such cases, the diminution in the size of the head will as a rule be unnaturally exaggerated, because the length of focus of an ordinary lens is much shorter than that of the eyes of an ordinary observer. If the perspective is not natural, the photograph cannot be artistic.

In order to preserve harmony in the graceful curves of the upper line of the body, the horse, to look his best, should have his ears pricked forward, his head carried high, and, if possible, he should not have his tail tucked in between his legs. When standing still, he will look to most advantage when the fore leg of the observer's side is more advanced than the other, and when the hind leg of the same side is more drawn back than the other hind leg (Figs. 308 and 593). Unless the background be a specially prepared one, the horse should be well away from it, and it should be out of focus, so that he may stand out in bold relief. As a rule, the animal, even when he is a grey or white, should be placed, more or less, against the sky. If possible, the horse should not be put, as is frequently done, close against a building, the lines of which would prevent the eye from following the contours of the animal. Horses look more animated and hold themselves better, away from their stables, than near them; and especially when they are in an open plain.

A reinless bridle is seldom if ever seen on a horse, except in photographs (Figs. 566 and 585).

CHAPTER XXXVII.

PROPORTIONS OF THE HORSE.

BOURGELAT, Merche, Duhousset, Goubaux, Barrier, and other writers on Conformation have laid down certain proportions for an ideal horse, which, unfortunately, does not exist as a distinctive type. Failing to draw sufficient attention to the great difference of shape between horses of speed and those of strength, the comparisons which they have instituted between the dimensions of the limbs and those of the head and body are wholly arbitrary. Although the respective proportions of the head and body are nearly the same in all classes of horses, the length of the neck and limbs varies according to the work for which the muscles of these parts are best suited. Hence, the only proportions of the horse which are fixed within narrow limits are those of the head and body. We may sum up the most evident ones as follows :—

Proportions Common to all Classes of Horses.

The measurements here given have reference to Fig. 646.

(1) Length of body (*a b*) = $2\frac{1}{2}$ to $2\frac{2}{3}$ times length of head (*k l*).
(2) Height of withers (*c d*) = height at croup (*f g*).
(3) Length of head (*k l*) = depth of body at lowest part of back (*h i*).
(4) Length of head= distance of "swell" of muscle at posterior angle of shoulder-blade to point of hip (*s t*).
(5) Distance (*k p*) of top of head to corner of mouth = distance from point of hip to point of buttock (*t u*).
(6) Width of head (*m n*) = $\frac{1}{2}$ length of head *k l*).

That careful observer, Colonel Duhousset, states that

(7) Length of head = distance of point of shoulder to top of withers.

As this proportion must necessarily vary according to the length and position of the shoulder-blade, I refrain from applying it to all classes.

The following proportions are approximately correct for all horses, except those of the heavy cart type, whose necks are particularly massive, as in Fig. 11 :—

(8) Width of head (*m n*) = width of upper part of neck (*n o*).

(9) Distance (*k p*) of top of head to corner of mouth = thickness of base of neck (*q r*).

Any attempt—as has frequently been made—to for-

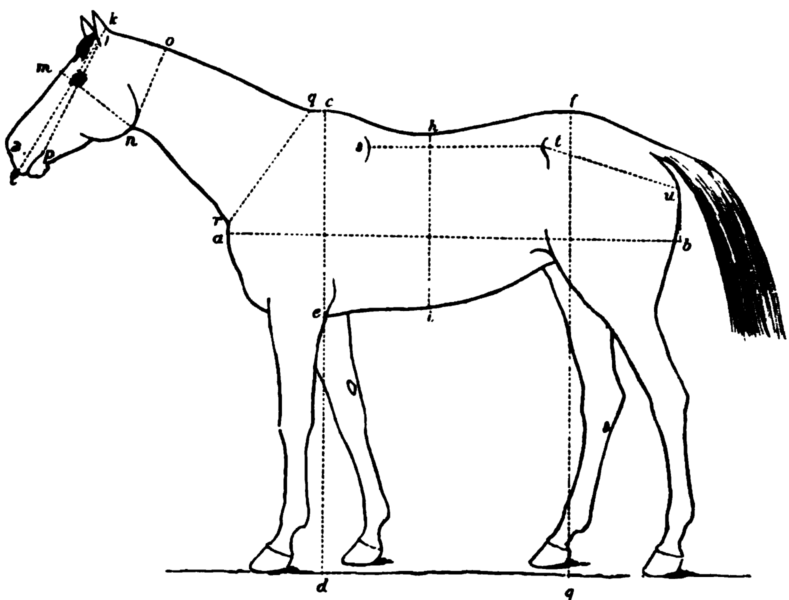

Fig. 646.—Proportions of Horse.

mulate proportions of length between the limbs and body of what might be called an "ordinary horse," would be merely begging the question by constructing an ideal animal to conform to one's own theories; instead of, as one ought to do, supporting one's hypotheses on the firm basis of fact. As the comparative length of limb varies according to the class of horse; we find (Chapter XV.), taking the two extreme types, that the legs of the heavy cart-horse are far shorter than those of the racer. Thus, in the cart-horse, the length of the body and its depth at the withers are, respectively, several inches more than the height, and the distance of the brisket from the ground. The racer, on the contrary, is inclined to be shorter than he is high, and measures much less from the withers to brisket than from brisket to ground.

As the result of my own observations I may add the following proportions for thorough-breds only :—

(10) Height at withers (*c d*) = length of body (*a b*), or a little (say, up to 4 inches) more.

(11) Depth of body at withers (*c e*) = distance of "girth place") to lower part of fetlock in a three-year-old, or to centre of pastern in an "aged" horse.

Beyond repeating (p. 184) that the muscles of the neck should be proportionate in length to those of the limbs, I can offer no useful hint as regards the comparative length of the neck ; for the only measurement which can be readily taken of it, namely, that from the withers to the top of the head, greatly alters in length, on account of the elasticity of the connecting ligament (p. 39), according to the position in which the head is held. We must here remember that this suspensory ligament of the head and neck is immediately underneath the crest, and that the vertebræ of the neck (Fig. 18) do not follow this line.

CHAPTER XXXVIII.

THE PAINTER'S HORSE.

HORSES have been treated by painters, and also by sculptors, in a very unhandsome way, and especially by English so-called artists who continue to perpetuate the conventional or stencil-plate animal in a style long since forsaken by Continental draughtsmen. There are, of course, several brilliant exceptions. The most usual faults of conformation to be seen in horse pictures, are absurdly small heads and extravagantly long hind-quarters, from point of hip to point of buttock, as we may see in Figs. 647 and 648. The former is a sketch of an equestrian portrait, by the French artist Parrocel, of Louis XV. in his youth. The latter is from *Beauties and Defects in the Figure of the Horse*, by H. Alken, who published it about eighty years ago, and who described the subject of his work as follows : " The animal from which this drawing was made, is accounted one of the finest figures in England." He must have had some misgivings about the dimensions of the head and neck ; for he takes care to add that : " A small head and neck in a horse are considered a great beauty ; and in the original of this drawing, I think they are the least I ever saw in proportion to the body." All the saddle-horses of some English artists, among whom was that unrivalled caricaturist, Mr. John Leech, have a remarkably " good place for the collar " on their shoulders. " The old masters " drew horses very incorrectly ; and yet we find in the bas-reliefs of the Parthenon done over two

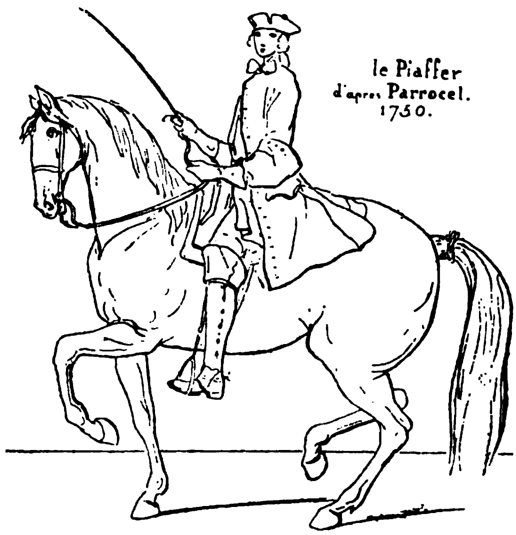

Fig. 647.—Louis XV. (*Copied from Duhousset*).

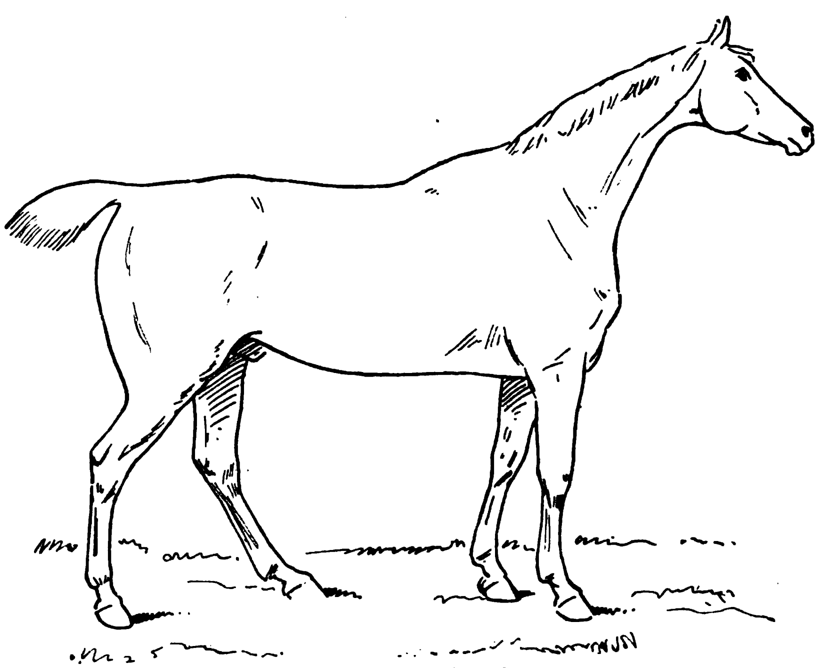

Fig. 648.—Horse by Alken.

thousand years ago, horses depicted with a nearer approach to truth both in form and action (Fig. 649). Meissonier drew horses with marvellous correctness, as we may see in his "Napoléon 1er" (Fig. 650), and in "1814" (Fig. 651). He was attentive to truth in the proportions of his horses, and was also singularly happy in catching the character of different classes and breeds; for instance,

Fig. 649.—Horse and Rider in the Parthenon.

compare (leaving out the question of attitude) the Arab horse in Fig. 650 with that in Fig. 340.

Some represent the walk by the action of the trot. Even Géricault gave the movements of the amble for those of the walk, as Duhousset shows us in *Le Cheval*. A well-known English artist drew a picture of Napoleon's charger, Marengo (Fig. 652), balancing himself on a fore and hind leg of the same side! Artists of the present time have no excuse for similar lapses into error; for they have the results of the researches of Marey, Muybridge, Anschütz, and other authorities to guide them. Photography proves that the walk (Figs. 99 and 653), trot (Figs. 81 and 654), amble (Fig. 98), canter (Fig. 148), gallop (Fig. 655), and leap (Figs. 247, 248, 251 and 658) can be drawn artistically and truthfully at the same time. A combination of these two conditions is harder to find in the canter, and especially in the gallop, than in the other movements. The difficulty, here, lies in the nature of the

Fig. 650.—Meissonier's Napoléon I^{er}.

action rather than in the speed of the pace; for the eye can, for instance, follow the order in which the limbs work far more easily in the fastest trot or amble than in the slowest walk. Here we come to the noteworthy fact that the eye will seldom recognise as true in Art, what it has not actually seen in Nature. The distance from which we usually look at the movements of a horse's legs in the canter or gallop, is usually too close to permit us to take in all four together at the same moment. Hence, when critically regarding the action in either of these two paces, we generally content ourselves with studying that of the fore pair, and, subsequently, that of the hind pair; or *vice versâ*. In such a case, therefore, whichever pair be focussed sharply on the retinæ of our eyes, the other pair will of necessity be blurred. Consequently, if both pairs

Fig. 651.—Meissonier's "1814."

of limbs be depicted sharply in the canter or gallop, the chances are that the idea of motion will not be conveyed to the spectator. For this reason, the painter who is trying to give the "feeling" of motion to a horse he is drawing at either of these paces, will do well to blur (by means of dust, snow, etc.) or to hide (by a bush or grass, for instance) one pair, if he desires to make the other pair sharp. I can see no error of technique in giving indistinctness of outline to the limbs themselves. A painter who exhibited in the Royal Academy or Salon, a picture representing a horse running away with a carriage, would most probably incur no rebuke from the art critics for blurring all the spokes of the wheels, and drawing all the legs and feet of the animal sharp. And yet those of us who know anything of the laws of motion, must be aware that, in such a case, any one of the horse's feet which is going forward, must be passing far faster through space, than the more or less perpendicular spokes which are revolving through the lower half of their circle! The blurred appearance of the

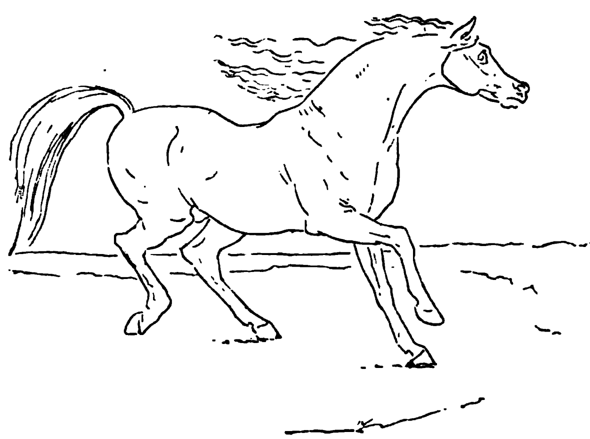

Fig. 652.—Napoleon's charger, Marengo. (*After Mr. James Ward, R.A.*)

near fore foot of the horse in Fig. 655, shows that that foot was rapidly going forward at the moment the photograph was taken. The fact of the horse pulling his rider out of the saddle, gives the idea of movement, which Fig. 656 fails to convey.

At paces in which there is a moment of suspension, the idea of motion, will, as a rule, be best conveyed by drawing the horse with his feet off the ground (Figs. 98 and 189). On account of violating this principle, old time painters, who represented the horse in the gallop with both hind feet on the ground, failed to give the idea of movement; although, as it happened, the attitude they adopted was not far from true (Fig. 655).

The later method of showing the racer at full speed, suspended in the air, with his fore legs stretched out in front and his hind limbs extended to the rear, was absolutely incorrect, as well as utterly impossible; and yet it con-

Photo by] [M. H. H.
Fig. 653.—Ganymede walking.

veyed the feeling of motion better than that practised by the earlier horse painters. It is manifest that a pictorial attitude which we *know* to be incorrect, will look unnatural

Photo by] [A. HAYES.
Fig. 654.—Trotting.

to us. Consequently, the more general knowledge becomes, the more difficult will it be for a painter who tries to draw horses in motion, to satisfy the artistic requirements of his public. Hence, pictures of galloping horses appearing to